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PLASTIC POLLUTION IN THE MARINE ENVIRONMENT

HEARING

BEFORE THE

NATIONAL OCEAN POLICY STUDY

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

ON

DISPOSAL OF PLASTIC WASTES IN THE MARINE ENVIRONMENT

JULY 29, 1987

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CONTENTS

	Page
Opening statement by Senator Breaux	1
Opening statement by the Chairman	2
Opening statement by Senator Stevens	2
Opening statement by Senator Lautenberg	3
Opening statement by Senator Kerry	32
Opening statement by Senator Bentsen	83

LIST OF WITNESSES

Cox, Joseph J., director, Marine Affairs, American Institute of Merchant Shipping; Dr. William Y. Brown, director, government affairs, Waste Management, Inc.; Lewis R. Freeman, Jr., vice president, government affairs, Society of the Plastics Industry; and Erik Stromberg, president, American Association of Port Authorities	89
Prepared statements:	
Mr. Cox	90
Mr. Brown	98
Mr. O'Connell	103
Mr. Stromberg	113
Douglas, James, Jr., Assistant Administrator for Fisheries, NOAA, accompanied by James Coe, Program Manager, Marine Entanglement Research Program, Northwest and Alaska Fisheries Center; Rear Adm. J. William Kime, Chief, Office of Marine Safety, Security, and Environmental Protection, USCG; Dr. Ronald B. Caffey, Assistant to Deputy Administrator for Plant Protection and Quarantine, Animal and Plant Health Inspection Service, USDA; Larry Koss, Ship Environmental Program Manager, Environmental Protection and Safety Occupational Health Division, Deputy Chief of Naval Operations for Logistics, Department of the Navy; and Dr. Tudor Davies, Director, Office of marine and Estuarine Protection, EPA	7
Prepared statements:	
Mr. Douglas	8
Questions of Senator Bentsen and the answers	12
Questions of the Chairman and the answers of Adm. Kime	16
Questions of Senator Bentsen and the answers of Dr. Caffey	20
Questions of Senator Bentsen and the answers of Mr. Koss	22
Dr. Davies	27
Liffmann, Dr. Michael, assistant director, Louisiana Sea Grant College Program, Center for Wetland Resources, LSU; Garry Mauro, commissioner, Texas State General Land Office; Roger McManus, president, Center for Environmental Education; and Sally Ann Lentz, counsel, Oceanic Society	40
Prepared statements:	
Mr. Liffmann	41
Mr. Mauro	49
Mr. McManus	58
Ms. Lentz	68

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

Ball, William L., III, Assistant to the President, The White House, letter	130
Chafee, Hon. John H., U.S. Senator from Rhode Island, statement	120
Dearborn, Ronald K., University of Alaska at Fairbanks, statement	122
Greco, James R., Browning/Ferris Industries, statement	125
Lambright, Stephen K., vice president and group executive, Anheuser-Busch Co., Inc., statement	127

PLASTIC POLLUTION IN THE MARINE ENVIRONMENT

WEDNESDAY, JULY 29, 1987

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
NATIONAL OCEAN POLICY STUDY,
Washington, DC.

The subcommittee met, pursuant to notice, at 9:35 a.m., in room SR-253, Russell Senate Office Building, Hon. John B. Breaux presiding.

Staff members assigned to this hearing: Mike Nussman, professional staff member, and Bob Eisenbud, minority staff counsel.

OPENING STATEMENT BY SENATOR BREAUX

Senator BREAUX. The subcommittee will please come to order this morning.

The National Ocean Policy Study will receive testimony regarding what may become one of the most persistent marine pollution problems confronting this committee, plastic pollution. Unlike oil spills or the dumping of sewage sludge, the consequences of the disposal of plastic waste into the marine environment may reach several hundred years into our future.

In my other role as Chairman of the Nuclear Regulation Subcommittee, we wrestle every day with the challenge of regulating the handling and disposal of waste with dangerous life spans of literally thousands of years. Unlike nuclear waste, the disposal of plastic waste occurs every day in virtually everywhere man enters the marine and coastal environments.

So ubiquitous is the disposal of plastics in the ocean that it can be compared to nonpoint sources of pollution such as acid rain or agricultural runoff. In that respect, it may be one of the most difficult sources of pollution to effectively monitor or to control and is a problem of immense proportions.

This Nation's merchant marine, commercial fishermen, recreational boaters, many cities, even our own navy is helping us to dispose into the ocean a large part of the 50 billion pounds of plastic products produced in this Nation every year. Of course, the problem is not confined to this Nation. One only needs to visit some of the more popular beaches along the Gulf Coast or those surrounding the New York bite area to grasp the truly staggering proportions of the problem.

Tragically, the impacts are not confined to aesthetics, as each year hundreds of thousands of sea birds and marine mammals perish as they consume or become entangled in any number of forms of plastic debris. Even human life is threatened when vessels become disabled as their propellers become fouled in plastic debris.

As I expect many of our witnesses will stress today, the nature and extent of the marine plastics pollution situation is apparently well researched and documented. In fact, it is time to move forward beyond further studies and to begin to apply meaningful solutions.

I look forward to learning today of the noteworthy but expensive efforts at state and local levels to clean up the daily onslaught of garbage spoiling our valuable beach resources. I understand the environmental community has been very active in this regard as well.

Furthermore, I look forward to discussing the merits of applying the recommendations of the international community to our domestic law and how our many Federal agencies can best coordinate their efforts.

I understand that ratification of Annex V of the MARPOL Convention is soon to be considered by our Foreign Relations Committee and that such ratification by the United States will put Annex V over the threshold necessary to take effect.

Thus, our discussion today will be central to these important deliberations as well as to our own efforts to develop implementing legislation that is both responsive and appropriate to our domestic needs and interests.

I have statements from the Chairman, Senator Hollings and also Senator Stevens.

[The statements follow:]

OPENING STATEMENT BY THE CHAIRMAN

Good Morning. Today the Commerce Committee and the National Ocean Policy Study will focus on the problem of plastic debris in the marine environment. This trash is accumulating in our ocean and coastal waters at an alarming rate. I know that in my home state of South Carolina, we find a variety of plastic trash, including discarded fishing gear, plastic strapping and wrapping materials, bottles, and food bags, littering our otherwise scenic beaches. And while we in South Carolina don't have as serious a problem as in other areas, such as the Gulf of Mexico, I do understand the concern. These plastic products don't break down; they persist in the marine environment for decades.

My concern with plastic pollution is not just one of aesthetics. Each year, many birds, fish, and sea turtles die from ingesting or becoming entangled in plastic debris. I understand that these wastes kill an estimated one million seabirds and one hundred thousand marine mammals annually.

Back in April, I joined with Senator Stevens and 28 other senators in sending a letter to President Reagan requesting his assistance in developing a strategy to resolve this problem. I understand that the President's response to that letter may be discussed here today.

In addition, I look forward to testimony on Annex V of the MARPOL convention. It was submitted to the senate for advice and consent on February 17 of this year and the Foreign Relations Committee has scheduled a hearing this week. I expect implementing legislation to be submitted to this Committee shortly.

Let me thank and welcome the witnesses here today. I look forward to their comments on this serious problem.

OPENING STATEMENT BY SENATOR STEVENS

Anyone who enjoys or benefits from America's coastal and marine resources can appreciate the need to address the marine plastic debris problem. In Alaska, even

on the most remote beaches one can find plastic debris. Plastic nets, pellets, and six-pack harnesses are common sights. These items are not only unsightly but extremely dangerous to man and wildlife.

Plastic netting and packaging straps can entangle marine life causing drowning or starvation. Boat propellers can become fouled with plastic debris endangering the lives of those aboard the disabled vessel. An increasingly serious problem is that posed by the growing driftnet fisheries of Japan, Republic of Korea, and Taiwan in the North Pacific Ocean. There is enough plastic monofilament driftnet currently in use in the North Pacific to encircle the globe at the equator slightly over four times. Although only a small percentage of this netting is lost or discarded yearly, it is estimated that over 1000 miles of plastic driftnet is lost in the waters of the North Pacific every year. These nets will persist for years continuing to entangle and destroy marine mammals, birds and fish. The decline in stocks of Pribilof Island fur seals is to be blamed in part on the mammal's entanglement in discarded driftnets and other plastic debris. Losses to the fishermen of Alaska due to plastic driftnets are estimated at 1.3 million fish. It is my fear that if something is not done soon the North Pacific will become essentially a "plastic ocean".

To address these problems, I have taken a number of steps in the 100th Congress. Early in this Congress I introduced a bill to monitor, assess and reduce the adverse impacts of driftnets on the living marine resources of our oceans. This bill, S. 62, among other provisions, establishes a buffer zone around the Aleutian Islands within which the use of driftnets is prohibited. This buffer zone is intended to protect the important seabird rookeries found in the Aleutian Chain. The bill also instructs the Secretary of Commerce to conduct research and report on the adverse impacts of these plastic nets on the marine environment.

Also in this Congress I initiated a letter, signed by myself and 29 other Senators, to President Reagan asking that an interagency task force be organized to assess the marine plastic debris problem and formulate possible solutions. As a result of this letter a high-level interagency task force, chaired by the National Oceanic and Atmospheric Administration (NOAA) has been established to assess the problem and consider actions which will begin to reduce marine plastic pollution. We expect a report to this effect within six to nine months.

Finally, I proposed an amendment to the NOAA Program Support Authorization Act which instructs the Secretary of Commerce to ensure that the issue of marine plastic debris should receive priority attention and support in the planning, evaluation, funding, and conduct of activities of the Department of Commerce. This amendment was accepted and the Act was reported out of the Senate Commerce Committee last month.

In February 1987, President Reagan transmitted Annex V of the International Convention for the Prevention of Pollution from Ships, to the Senate with a strong recommendation for ratification. This provision specifically prohibits the dumping of plastic debris from ships. I believe that it is imperative for Congress to make the enactment of implementing legislation for Annex V a top priority. I look forward to working with my colleagues in the Senate toward this end.

Senator BREAUX. We are very pleased to have the Senator from New Jersey, Senator Lautenberg, who has already introduced legislation and has been very active in pushing our Nation towards a better plan for handling this immense problem and has been a leader in this field as our first witness this morning.

We had our other colleague scheduled, Senator John Chafee of Rhode Island, but because of his attendance at the services for former Secretary of Commerce, Mac Baldrige, he will be unable to be with us. He will be submitting a statement, but we are very pleased to have Senator Frank Lautenberg.

Frank, glad to have you.

OPENING STATEMENT BY SENATOR LAUTENBERG

Senator LAUTENBERG. Thank you very much, Mr. Chairman. You have helped identify the problem in your opening remarks, and I thank you for holding this hearing and for the opportunity to testify before you this morning.

The Commerce Committee and the National Ocean Policy Study on which I serve are examining a critical environmental issue facing the Nation, and that is the protection of our coastal areas from plastic pollution. Earlier this year, I introduced the Plastic Pollution Control Act of 1987, S. 633. This bill responds to the pervasive threat to our coastal communities. It is a threat to our beaches and, of course, our oceans.

Since then, the Environment and Public Works Subcommittee on Environmental Protection on which I serve has held two hearings on pending plastics legislation. I chaired the second hearing in Asbury Park, New Jersey earlier this month. We heard from environmentalists, fishermen's representatives, local, State and Federal officials and representatives from our State's tourism and business community.

All of them agreed that a significant threat exists and that current laws are not sufficient to address the problem. The very characteristics of plastics that makes them valuable, their durability, makes them a serious problem for our marine life, waterways and coastal areas.

Now, my State has seen plastic pollution firsthand. Recent beach closings in Ocean County, New Jersey gave another example of the problem. Miles of our coast were scarred with tampon applicators, condoms, other floatables and six pack rings. Over the years we have seen hospital wastes such as used syringes on our beaches. We have seen plastic containers. We have seen it, and we know what it means to the environment and to the economy.

Our tourism industry depends on clean beaches. About $7 billion a year flows into New Jersey from coastal tourism activities. We want our beaches to be clean and our tourist industry to thrive. Existing law has not been effective in preventing plastic pollution of our oceans and shores. It is a problem for tourism, for swimmers, for recreational boaters and for our fishermen and for our marine and wildlife which choke or strangle on plastics.

Where does it come from? There are various possible sources. In my State, one culprit nearby is actually a landfill. Garbage, including disposable plastic products such as hospital waste is barged out to this landfill, the Fresh Kills Landfill on Staten Island, New York. The garbage has been allowed to fall into the water from the barges and from the landfill itself, and this refuse then washes up on New Jersey's beaches and pollutes our waters.

Other possible sources include ships at sea. They produce large quantities of plastics refuse and other garbage.

Littering also contributes to the problem. Last September on the beaches of Sandy Hook, 100 New Jersey environmentalists collected vivid proof of this threat. They reported that in a little over an hour 15 of these so-called trash attackers picked up a giant haul from one of the beaches: 700 plastic containers and six pack rings; 600 plastic tampon applicators; and other refuse. When the effort was over, the group had filled a flatbed truck with garbage, of which 80 percent was plastic.

The evidence continues to grow about marine animals entangled in plastic debris and marine animals that have swallowed and choked on plastic junk. Birds and even the great whales have become victims of plastics carelessly discarded into the ocean. Vir-

tually every marine species is susceptible to the dangers of plastic debris.

Despite such evidence, plastics continue to be dumped. In the Northern Pacific Ocean, as many as 250,000 birds and at least 30,000 northern fur seals reportedly die each year from plastic entanglement.

That is the problem, but what is the solution? We have laws on the books. We have the Refuse Act of 1899, the Clean Water Act and the Ocean Dumping Act, but they were not designed and they are not enforced to address this kind of plastic pollution.

We have an international law. It is Annex V to something called the International Convention for the Prevention of Pollution from Ships, but it has not been ratified by the United States. As you mentioned, Mr. Chairman, I hope that the Senate will act promptly on Annex V. Ten of my colleagues on the Senate Environment and Public Works Committee recently joined me in urging the Foreign Relations Committee to act to ratify the agreement. The Foreign Relations Committee has scheduled a hearing on Annex V on Friday.

Even if the United States ratifies this agreement, however, the Annex may not enter into force for several years. So there is an enormous gap in our pollution laws, and my bill would close it. The bill would ban the disposal of plastic products all the way out to the 200 mile limit. It would not allow plastics disposal on beaches and landfills where the junk could be washed up or blown into the water.

Violators of this new law would be hit by stiff criminal and civil penalties. The bill allows citizens and local officials to sue to enforce the new law.

We would also have EPA study ways to eliminate plastic pollution. Can we use alternative products? Would labeling help? There is also the question, of course, of degradable plastics.

The bill also mandates a comprehensive public awareness program about plastic pollution.

Finally, the bill would implement Annex V.

The Environment Committee is now considering this legislation and related measures that are sponsored by Senator Chafee.

Mr. Chairman, the plastics problem is a serious one and demands a comprehensive response. Congress has got to act to protect our coastal environments and those economies from this threat, and I hope that the Senate is going to lead the way.

I thank you, Mr. Chairman, for the opportunity to be with you this morning.

Senator BREAUX. Thank you very much, Frank, for your leadership in this area and for your persistence. It is going to take that.

I remember in 1978 chairing a hearing on Long Island about this problem. It is deja vu all over again. We are still talking about it almost 10 years later. I think everybody knows what needs to be done. It is just a question of getting us to move on Annex V and getting it adopted, and I think your legislation goes a long way.

I guess the real problem is enforcement. I do not know how we are going to adequately enforce this bill, but unless we get it adopted we are not going to have to worry about enforcement.

So I commend you. I take it the Foreign Relations Committee is going to move maybe this week on approving Annex V, which will at least get this mechanism going.

Senator LAUTENBERG. Well, it will be a start, but unless we get 50 percent of the world shipping tonnage to agree, Annex V does not move either. If the United States adds its roughly 4.5 percent of the world shipping tonnage to that which has already signed up, we will still be less than 50 percent.

Eventually, I do not see Annex V and our bill competing at ail. If they compete, it is on behalf of a cleaner environment. We just have to move this thing along. I am pleased to see the action taking place because it may induce others to join in and get done with this, at least start to close the loop on this.

The material is awful. You see those pictures. I do not know who put those up, but they are pretty demonstrative of the problem.

Senator BREAUX. I remember we had the hearings up in Suffolk County on Long Island. Our leadoff witness at that time was Al D'Amato, who was County Supervisor. They talked about everything they were doing on a county level to prevent people onshore from dumping the stuff on the beaches, but that in no way affected everything that was washing on shore from the ships traveling just outside the 12 mile limit.

So we thank you for your leadership and hope you will be able to move very quickly on your legislation.

Thank you very much.

Senator LAUTENBERG. Thank you.

Senator BREAUX. I would like to welcome up at this time our first panel of witnesses, consisting of Mr. Jim Douglas, who is Assistant Administrator for Fisheries with NOAA; Rear Admiral John Kime, who is Chief of the Office of Marine Safety with the United States Coast Guard; Dr. Ronald Caffey, Assistant to the Deputy Administrator for Plant Protection and Quarantine with the United States Department of Agriculture; Mr. Larry Koss, who is Ship Environmental Program Manager for the Navy Department; and Dr. Tudor Davies, who is Director for the Office of Marine and Estuarine Protection with the EPA.

If you would take your seats, we would be pleased to receive your testimony.

We would like to ask you to summarize your testimony so that we can get on to asking the questions that we need for the record.

Jim Douglas, we have you listed first, and we would be pleased to receive your testimony.

STATEMENTS OF JAMES DOUGLAS, JR., ASSISTANT ADMINISTRATOR FOR FISHERIES, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE, ACCOMPANIED BY JAMES COE, PROGRAM MANAGER, MARINE ENTANGLEMENT RESEARCH PROGRAM, NORTHWEST AND ALASKA FISHERIES CENTER; REAR ADM. J. WILLIAM KIME, CHIEF OF THE OFFICE OF MARINE SAFETY, SECURITY AND ENVIRONMENTAL PROTECTION, U.S. COAST GUARD, DEPARTMENT OF TRANSPORTATION; DR. RONALD B. CAFFEY, ASSISTANT TO DEPUTY ADMINISTRATOR FOR PLANT PROTECTION AND QUARANTINE, ANIMAL AND PLANT HEALTH INSPECTION SERVICE, U.S. DEPARTMENT OF AGRICULTURE; LARRY KOSS, SHIP ENVIRONMENTAL PROGRAM MANAGER, ENVIRONMENTAL PROTECTION AND SAFETY OCCUPATIONAL HEALTH DIVISION, DEPUTY CHIEF OF NAVAL OPERATIONS FOR LOGISTICS, NAVY DEPARTMENT; AND DR. TUDOR DAVIES, DIRECTOR FOR THE OFFICE OF MARINE AND ESTUARINE PROTECTION, ENVIRONMENTAL PROTECTION AGENCY

Mr. DOUGLAS. Thank you, Mr. Chairman. I am James Douglas, Jr. I am the Acting Deputy Assistant Administrator for Fisheries of the National Oceanic and Atmospheric Administration, which is part of the Department of Commerce.

Mr. Chairman, I want to introduce to you a gentleman I have with me today, Mr. James Coe, who is the Program Manager for NOAA's Marine Entanglement Research Program at our Northwest and Alaska Fisheries Center in Seattle. We appreciate the opportunity to appear before you today to present the Department's views on the problem of plastic pollution in our oceans.

One of the most prevalent debris on the ocean surface the world over is the particulate remains of manufactured plastic items. Such material, plus lost fishing gear and other plastic debris, causes problems for a variety of wildlife. Ingestion and entanglement are major problems to marine mammals, turtles, sea birds and fish. Even if not killed directly by such material, the animal may be wounded, lose its ability to evade predators or lose its ability to catch food.

Although we know that all these things can and do happen to marine animals, we do not know the extent of these occurrences. Consequently, it is difficult to determine the impact of this pollutant on the health of the affected stocks.

NOAA is currently in the third year of studying marine debris. Our focus, which comes from the findings of the International Workshop on the Fate and Impacts of Marine Debris, has been in four areas: One, the sources of plastics; two, the effects on wildlife; three, public education; and four, a means for reducing the introduction of plastics to the marine environment.

A cornerstore of these efforts has been a public awareness program that initially concentrated on industrial sources of debris in the North Pacific Ocean. This educational effort has since expanded to the East Coast and the Gulf of Mexico and has even been international in scope with presentations in Japan, the Republic of Korea and Taiwan.

To aid our present studies and give better focus to our future studies, NOAA formed a voluntary informal national discussion group called the Marine Debris Roundtable. This group includes representatives from government, the fishing industry, port authorities, merchant shipping, the waste management industry and the plastics industry

Our meetings with this group show us that there is much work to be done, and there is a cooperative and positive attitude by all parties. So we are very optimistic that we can and will find acceptable solutions in the future.

Mr. Chairman, NOAA fully supports the U.S. ratification of optional Annex V to MARPOL as a rational step in the global management of plastics in the ocean.

We also endorse the Administration's proposal of legislation to implement Annex V, as enunciated by the Coast Guard. We respectfully defer to the Coast Guard on all questions of implementation and enforcement, but it would assure them and this committee that NOAA is ready to use its oceanographic and fisheries expertise to assist in any way that we can to assure a smooth and effective implementation.

Lastly, let me take a moment to address the April 2, 1987 letter from 30 Senators to the President on the subject of marine debris. By now you should have a response from the Domestic Policy Council. An interagency task group has been established. Invited participants include NOAA, the Department of Agriculture, the Council on Environmental Quality, the Office of Management and Budget, Coast Guard, the Navy, the Office of Domestic Policy, the Department of State, the Environmental Protection Agency, and the Department of the Interior.

This task group will serve as the coordinating and reviewing group to develop the responses that address the issues raised in the Senators' letter. We expect this task group to have a report to the Domestic Policy Council within about six to nine months.

Mr. Chairman, I think that is a brief synopsis of my written statement, and Mr. Coe and I will try to answer any questions you might have, sir.

[The statement and questions follow:]

STATEMENT OF JAMES E. DOUGLAS, JR., ACTING DEPUTY ASSISTANT ADMINISTRATOR FOR FISHERIES, NATIONAL MARINE FISHERIES SERVICE, NOAA

Mr. Chairman and Members of the Subcommittee: My name is James E. Douglas, Jr. I am the Acting Deputy Assistant Administrator for Fisheries of the National Oceanic and Atmospheric Administration (NOAA), Department of Commerce. Accompanying me is Mr. James Coe, Program Manager for NOAA's Marine Entanglement Research Program at our Northwest and Alaska Fisheries Center in Seattle, Washington.

I appreciate the opportunity to appear before you today to present the Department's views on the problem of plastic pollution in the oceans.

Through NOAA, the Department is involved in a number of efforts to address the problems related to pollution in the oceans. On a national level, NOAA is working with other Federal agencies and various university, State, industry, educational, recreational associations and environmental groups. Our efforts are also international in scope. Let me point out some of these efforts and our findings to date.

NOAA EFFORTS

In response to the growing problem of marine plastic pollution, and with the urging of Congress, NOAA established a Marine Entanglement Research Program

in 1985. The goals and objectives of this program were developed from recommendations that came out of the international Workshop on the Fate and Impacts of Marine Debris held in Honolulu, Hawaii, in November 1984. Our program addresses four broad activities: (1) sources of plastics (containers, bags, etc.) that are found in the oceans and along our coasts; (2) mortality to wildlife caused by plastics in the marine environment; (3) educating the public about the plastic pollution problem; and, (4) practical means for the reduction of plastics in the oceans, such as waste management systems (incineration, recycling, and compaction) and photo degradation and biodegradation technology. In FY 85, Congress provided $1 million for this program. For FY 86, and FY 87, the appropriation from Congress was $750,000.

SOURCES OF PLASTICS

The marine pollution literature identifies sources of plastics in the oceans as vessel-generated refuse, waterborne municipal and industrial wastes, and terrestrial litter transported by river systems. Certainly, the most prevalent debris on the ocean surface the world over, is the particulate remains of manufactured plastic items. All plastic materials free in the environment are eroded into even smaller particles which are carried by water to either the ocean or freshwater basins. A recent study in the central North Pacific found that these nondescript plastic fragments accounted for as much as 91 percent of the floating debris which averaged almost 50,000 pieces per square kilometer.

Lost and discarded fishing gear is another important component of plastic debris because of the potential hazard it poses for wildlife. In addition to the effect on wildlife, fishermen also suffer when rope or derelict fish net entangle propellers and drive shafts. In addition to the increased risk to navigation, these situations cause economic loss to the vessels and loss of fishing time. Estimates for the world-wide loss of plastic fishing gear range as high as 135,000 metric tons per year. Surveys of litter on the remote beaches throughout the Pacific show high densities of lost commercial fishing gear. Beach surveys at Amchitka Island in the Western Aleutians show about six out of seven items were fishing gear and two-thirds of the total items were trawl web fragments. Similar beach surveys in Southeast Alaska and voluntary beach clean-ups all over the country, however, indicate a much lower ratio of fishing gear to other refuse. Fishermen are apparently aware of the problem and are willing to help solve it. They hope that others who are part of the problem will join in the solution.

MORTALITY TO LIVING MARINE RESOURCES

The Marine Entanglement Program uses part of its funding to assess and monitor the effects of debris on protected and commercial species. The persistent and buoyant nature of these materials causes them to remain in the marine environment for extended periods of time. As a result, they pose a threat to marine mammals, turtles, seabirds, fish, and other living marine resources. Individual animals can become entangled in drifting nets or other debris, or they can ingest some of the materials. Animals which are entangled can drown, incur wounds or injuries, or lose their ability to avoid predators or to catch food. Other animals which ingest synthetic debris suffer from blocked digestive tracts. Synthetic debris may be a factor in the declines of several species, including the northern fur seal, steller sea lion, Hawaiian monk seal, and certain sea turtle and seabird populations.

Because many of these species live a large part of their lives at sea, most evidence comes from strandings and other chance encounters. It is difficult to draw precise conclusions about the effects of plastic pollution on fish and wildlife populations. However there is no doubt that many marine mammals are killed by becoming entangled in nets and other synthetic debris. The role of entanglement in the population dynamics of these animals is under continuing investigation.

Both entanglement in, and ingestion of, plastic debris, and documented causes of death and debilitation for sea turtles and seabirds. All species of sea turtles are classified as either threatened or endangered, under the Endangered Species Act, so there is legitimate concern over the role of plastic debris in their life history and population trends. Ingestion of plastic is also common among surface feeding and diving seabirds.

PUBLIC EDUCATION

There is a solid consensus among scientists, fishery and wildlife managers, and environmental interests that education will play a primary role in controlling plastic pollution. Under the Marine Entanglement Research Program, we initially de-

veloped an education program concentrating on the industrial sources of debris in the North Pacific Ocean. This educational program has now been expanded to the East Coast and Gulf of Mexico. We are looking forward to the same level of cooperation and leadership from the industries of these regions as we have experienced in the North Pacific. New information generated by the Entanglement Program is continually being incorporated into the education presentations.

There is a growing public awareness of the plastic pollution issue. A number of voluntary actions have been initiated by concerned citizens. These include beach clean-up days, removal of underwater ghost nets and projects to monitor beaches for plastic trash. Perhaps continued emphasis on educational programs will increase the public's interest in solving the problem.

REDUCTION OF PLASTICS

This past December, the Marine Entanglement Research Program initiated the first meeting of the Marine Debris Roundtable, an informal, national discussion group focusing on solutions to the marine debris problem. Representatives of involved government agencies and industry participated. Industry representatives included the fishing industry, port authorities, merchant shipping, the waste management industry, and the plastics industry. Two major events discussed at this meeting are now certainties. First, an international fishing industry symposium on the marine debris problem and its potential solutions will be sponsored in late 1987 by a coalition of North Pacific rim fishing industry associations from the United States, Japan, the Republic of Korea, Canada, the U.S.S.R., and possibly Taiwan and the People's Republic of China. Secondly, in June of 1987, the Society of the Plastics Industry sponsored a national symposium in Washington, D.C., on the research, development, and marketing of controlled lifetime plastics (degradable plastics).

Also in June 1987, the Society of the Plastics Industry sponsored the second meeting in Washington, D.C., of the Marine Debris Roundtable. Discussions focused on implementation issues related to the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex V and the relationships between debris impacts research and plastics technology.

In conjunction with this meeting, NOAA convened a marine debris workshop in Washington, D.C. Representatives from Federal agencies, States, public interest groups and industry were present. The workshop focused on two major questions: (1) What will decisionmakers need to know; and, (2) What additional research is needed. A final report of the workshop discussions is now under review by the participants. We expect the final report of the proceedings to be completed by the end of August.

INTERNATIONAL EFFORTS

In 1986, as part of our North Pacific education program, presentations were made in Japan, the Republic of Korea, and Taiwan on the proliferation of plastic pollution. These presentations were made at the invitation of those governments. We consider these invitations a sign of genuine concern regarding the proliferation of plastic pollution. Japan and Korea already have domestic laws and programs focused on marine debris, including land as well as vessel-generated sources. Both countries also have commercial recycling programs in place to accept waste fishing gear.

Further demonstrations of the awareness of these governments of this issue are evident in cooperative research programs and in the negotiations currently underway for the placement of U.S. observers aboard foreign commercial squid fishing vessels. Because the high seas squid driftnet fisheries have been in existence for only a few years, insufficient data have been available to assess their overall impact upon the marine environment. To address this situation, the National Marine Fisheries Service (NMFS) took the initiative during the 1986 fishing season to work cooperatively with other nations to obtain data on these fisheries. We were successful in arranging for NMFS scientists to be placed aboard a Japanese commercial squid driftnet vessel, and high sea squid research vessel from Taiwan, Canada, and the Republic of Korea.

For the 1987 squid fishing season, we have already placed a scientist aboard Canadian and Japanese driftnet fishery research vessels and intend to place others aboard Taiwanese and Korean research vessels in the squid fishing area before the season is out. In addition, we are working with the Government of Japan to expand data collection efforts from commercial Japanese driftnet vessels during the next three years. We believe that the data collected through cooperative efforts will

assist NOAA in evaluating the impacts of high seas driftnet fishing on the living marine resources of the North Pacific Ocean.

FUTURE EFFORTS

NOAA has made a conscious decision not to use the Entanglement Program funds to quantify the input of plastic debris into the oceans. However the durability of most plastics, the increasing annual production of plastic resins, and the absence of new systems for refuse management lead us to believe that plastic pollution can only be increasing. Consequently, we are funding studies directed towards reducing the amount of nondegradable material that is disposed of or lost at sea. Photo and biodegradition technology, incineration, compaction, sorting and provisioning and recycling systems are all applicable in helping control vessel-source plastic pollution. We will be pleased to work with other agencies to address these concerns as the scope of technology for controlling plastic pollution broadens.

NOAA is also looking at the problem of adequate reception facilities at ports. Vessels that choose to retain their non-degradable refuse must have a suitable place to unload it. Preferably, this would be a place where refuse can be disposed in such a way that it can never re-enter the ocean environment. In anticipation of the U.S. ratification of Optional Annex V to MARPOL, NOAA has entered into a cooperative agreement with the Port of Newport, Oregon, to develop a prototype waste management system in the port to receive vessel-generated refuse. The results of this experience are expected to help other ports, large and small, deal effectively with the Optional Annex V requirement that ports provide this service. We point out that the fishing industry lands its catch in many small ports. In many of these ports there may be no public docks and facilities—only private facilities of the buyer. We must pay close attention to how this requirement is implemented.

MARPOL, ANNEX V

NOAA fully supports the U.S. ratification of Optional Annex V to MARPOL as a rational step in the global management of plastics in the oceans. NOAA endorses the Administration's proposal for implementing Annex V and expects to work with the Coast Guard to ensure equitable and appropriate solutions particularly as they relate to coastal and maritime industries.

The International Maritime Organization, through its Marine Environment Protection Committee (MEPC), is addressing the issue of plastic pollution and entanglement. NOAA is represented on the U.S. Delegation which presented a working paper on the implementation of Optional Annex V to the working group on optional annexes to MARPOL at the most recent meeting in February 1987. The working group requested that the United States prepare draft proposed guidelines for the implementation of Optional Annex V for presentation at the next MEPC meeting in December 1987. These guidelines will describe means for reducing the type of garbage and trash which must be disposed of by (1) modifying the types of materials taken on board, (2) more effective means of handling such materials taken on board, and (3) more effective means of disposal of such materials on vessels. The guidelines will also suggest methods by which countries can improve public knowledge of the problems caused by marine garbage and trash. NOAA has the lead on drafting these guidelines and is coordinating its efforts closely with the U.S. Coast Guard, Environmental Protection Agency, Department of State, Marine Mammal Commission and other interested organizations.

RESPONSE TO SENATE REQUEST

In regard to a letter sent to the President concerning persistent marine debris, signed by 30 Senators, a response has been sent by the White House. Consistent with previous Federal efforts, an interagency task force has been established under the Domestic Policy Council to address this issue. This task group met several weeks ago to review Federal efforts and identify other areas where the Federal Government can be effective in dealing with marine debris. This group includes ten departments or agencies and will meet periodically. The Domestic Policy Council expects to have a report within six to nine months which will assess the problem and the need for research, identify potential production measures, and consider alternative actions to address the problem of plastic marine pollution. We believe this will be responsive to the Senate's request.

This concludes my testimony. I am ready to answer any questions you may have.

QUESTION OF SENATOR BENTSEN AND THE ANSWERS

Question. I appreciate the cooperation which the National Oceanic and Atmospheric Administration pledged to the Center for Environmental Education in response to my request. Do you believe that the evidence will be adequate to support the U.S. proposal for designation of the Gulf of Mexico as a special area?

Answer. NOAA has supported the Center for Environmental Education (CEE) in its study to declare the Gulf of Mexico a Special Area under MARPOL Annex V, and has reviewed and provided comments on the draft of the study report, which is expected to be issued by CEE on or about September 1, 1987. In addition, NOAA has participated in meetings of the Texas Coastal Clean-up Steering Committee and is conducting a limited survey on entanglement and marine debris of the Upper Texas and Southwestern Louisiana coasts.

While NOAA supports the effort to designate the Gulf of Mexico a Special Area under MARPOL Annex V, we defer to the Coast Guard as the U.S. representative to the International Maritime Organization for a determination of the adequacy of the evidence to make such a designation.

Senator BREAUX. Very good, Jim. Thank you for summarizing.

Admiral, we are pleased to have you and look forward to your testimony.

Admiral KIME. Thank you, Mr. Chairman.

I am Rear Admiral William Kime, Chief of the Coast Guard's Office of Marine Safety, Security, and Environmental Protection at Coast Guard Headquarters here in Washington. It is indeed a pleasure for me to appear before you today to present our views as to the best means to control plastic pollution in the oceans and to highlight the relevant provisions of the administration's legislative proposal to implement Annex V of MARPOL through appropriate amendments to the Act to Prevent Pollution from Ships, or APPS.

I believe the legislation we have prepared would provide full protection to the U.S. coastline, encourage broad adoption of Annex V, and enhance its international enforcement.

Mr. Chairman, in previous testimony before other congressional committees, I have stated the Coast Guard's concerns regarding the hazards to the marine environment from garbage, particularly plastics and other synthetic materials including synthetic fishing nets; and I stressed the importance of establishing international standards to solve an international problem through implementation of Annex V of MARPOL. Currently, the principally applicable statute is the Refuse Act of 1899 (33 USC 407) which only prohibits the disposal of garbage into U.S. navigable waters including the territorial sea. Annex V would not only prohibit the discharge of plastics into the oceans of the world, but would also regulate disposal of forms of garbage other than plastics, generated during the normal operation of ships, beyond the territorial sea up to 25 nautical miles from the nearest land. I also emphasized that early U.S. ratification and implementation of Annex V would demonstrate to the world our resolve to protect the marine environment giving due consideration to the joint efforts of the international community.

Mr. Chairman, the Coast Guard's support for early ratification remains strong. In this regard, we have been working diligently over the past thirteen months since we began the formal process towards achievement of this highly worthwhile and desirable goal. I would now like to highlight the major aspects of these actions.

At the July 2, 1986 public meeting of the National Committee for the Prevention of Marine Pollution held in preparation for the

23rd session of the International Maritime Organization's, or IMO's, Marine Environment Protection Committee, the MEPC, members of the marine industry, environmental organizations and other public interests were asked to comment on Annex V regulations and the desirability of U.S. ratification. Those attending the meeting were unanimous in their support for ratification.

As head of the U.S. delegation, I announced to the MEPC my intention to recommend U.S. ratification of Annex V. This recommendation was subsequently included in the official delegation report to the Secretary of State.

Now you may ask what transpired between 1973 when the Annex was originally negotiated and the July, 1986, public meeting at which the U.S. first acknowledged broad interest in ratification. Annex V has not been ratified by the required number of countries representing sufficient tonnage to bring it into force internationally. The relative inactivity concerning this Annex has been primarily due to the higher international priorities for the entry into force and implementation of the mandatory Annexes I and II which prevent and regulate accidental and operational discharges of oil and noxious liquid substances shipped in bulk. Also, certain countries, including the U.S., have not ratified because they feel changes are necessary to make Annex V more meaningful and enforceable. In 1985, the U.S. interagency working group (consisting of representatives from the USCG, NOAA, EPA, Department of Interior, Department of Agriculture, Department of Transportation, and Department of State) studying Annex V recommended an amendment to Annex V to clarify and strengthen the prohibition on disposal of nonrepairable sections of synthetic fishing nets. I was the head of the U.S. delegation to the 21st session (April 1985) of the MEPC that formally presented this recommendation on behalf of the U.S. at its 23rd session (July 7–11, 1986) the MEPC agreed to this amendment which will be circulated in preparation for adoption as soon as Annex V enters into force.

In the fall of 1986, the Coast Guard worked extensively with the Department of State to prepare the documents necessary for ratification of Annex V. As you know, Mr. Chairman, on February 9, 1987 the President transmitted Annex V to the Senate for its advice and consent to ratification. As you have stated, at 10:00 on Friday the Senate Foreign Relations Committee will be holding hearings leading toward this advice and consent.

Also in the fall of 1986, the Coast Guard worked closely with NOAA and the Marine Mammal Commission to develop a U.S. proposal recommending the development of international guidelines to assist in the effective implementation and enforcement of Annex V, a point that you had stressed, Mr. Chairman. This proposal was submitted to the 24th session of the MEPC held this past February and was unanimously accepted.

Currently, the U.S. has taken the lead in preparing these draft guidelines with the assistance of information received from IMO member governments and international shipping, trade and observer organizations for submission to the 25th session of the MEPC scheduled for November 30 through December 4, 1987.

Mr. Chairman, at the last meeting of the MEPC, the mandate was given that this work should be completed at this upcoming session in the winter of this year.

The scope of these guidelines will include training, education and information programs for seafarers and the public on the marine debris problem, means to minimize the amount of potential garbage, shipboard storage and handling procedures for garbage, shipboard equipment for processing garbage, reception facilities and means to insure compliance with Annex V.

Mr. Chairman, I want to emphasize that this U.S. initiative has been extremely well received by the international community because it reinforces a fundamental principle of MARPOL; that is, to control pollution of the oceans from ships through global as opposed to unilateral standards because it is an international problem.

I believe working through MARPOL will ultimately facilitate better international cooperation regarding compliance with the requirements. For example, Mr. Chairman, we have experienced very high compliance rates for the Annex I provisions of MARPOL as identified through our vessel boarding enforcement program, with over 7,000 boardings in 1985 alone.

Preliminary indications for Annex II which just entered into force on April 6, 1987 are also very favorable. I am convinced this success is largely due to the global acceptance of these standards.

As you know, Mr. Chairman, several bills have been introduced in the House and Senate to implement Annex V. I would like to provide some general comments concerning these bills as they pertain to our legislative proposal which was transmitted to the House and Senate by Secretary Dole on July 22, 1987.

The administration believes that rather than enacting separate freestanding legislation to apply Annex V regulations that they be applied through appropriate amendments to APPS. APPS already provides the legal structure for applying the provisions of MARPOL annexes within the context of the overall convention regime, including the MARPOL annex amendment procedure prescribed in Article 16 of the convention.

Articles 4, 5 and 6 of MARPOL provide for enforcement on a port state, flag state basis. Our proposal would place primary reliance on this port state, flag state application and enforcement regime which has proven so effective in obtaining: one, broad international acceptance of MARPOL; two, agreement on U.S.-sponsored and supported measures to improve Annexes I and II; three, very high worldwide Annex I compliance rates; and four, meaningful penalties for violations of Annex I requirements when they occur.

More specifically, our proposal would divide the ships subject to Annex V into three categories. These are: Ships operating under the authority of the United States, ships operating under the authority of foreign countries which parties to Annex V, and ships operating under the authority of foreign countries which are not parties to Annex V. In so far as U.S. and other Annex V parties are concerned, our proposal follows the pattern employed by APPS. U.S. ships would be subject to Annex V requirements and the act's enforcement procedures wherever those ships are located.

Ships of countries which are party to Annex V would be subject to Annex V requirements and the act's enforcement procedures only while within the navigable waters of the U.S. beyond the territorial sea (3 mile limit) provision is made for forwarding evidence of violations of Annex V, wherever those violations occur, to the respective flag states for prosecution.

Ships of countries which are not party to Annex V would be subject to regulations conforming to and giving effect to Annex V requirements while they are in the navigable waters of the United States or the U.S. exclusive economic zone; and they would be subject to the act's enforcement procedures, consistent with customary international law, when they violate those regulations. In this regard, it is our view that when Annex V enters into force for the U.S., its relevant regulations can be applied in the exclusive economic zone to non-Annex V party ships as generally accepted international standards. We believe that this approach would provide full protection to the U.S. coastline and additional impetus for non-Annex V party states to ratify Annex V.

We are seriously concerned that United States application of the Annex V regime to the exclusive economic zone, in regard to vessels of other party states, would be counter productive. Such extension could deter broad, global acceptance; entry into force; enforcement and subsequent improvement of the Annex V regime.

It is also very important that the U.S. statutory regime implementing Annex V be linked to Annex V entry into force before making the regulations effective. This is necessary for application and enforcement of Annex V provisions to foreign vessels.

Annex V will enter into force 12 months after the date on which not less than 15 states representing 50 percent of the gross tonnage of the world's merchant shipping have become parties to it. This 12-month period is provided to give administrations time to develop, promulgate and legislate regulations and to insure that reception facilities are available.

Officially, 27 states representing 41.86 percent of the world's shipping tonnage have ratified it. We have recently learned, however, through an exchange of telexes on July 14 and 15 with my counterpart in the Soviet Union that they have just ratified Annex V and that official deposit of the instrument of ratification at IMO is forthcoming. This was subsequently confirmed by me through a telephone conversation with the IMO Secretary General.

This will bring the cumulative tonnage up to approximately 48 percent and has opened the door for the United States with 4.9 percent to bring the annex into force internationally. In short, Mr. Chairman, all eyes are upon the United States.

Mr. Chairman, substantial criminal sanctions and efficiently accessible civil penalties for violations of the Annex V regulations are critical to achieving effective enforcement. Our proposal would apply the same criminal sanctions and civil penalties that are currently in APPS and applicable to Annexes I and II.

Our legislative proposal also includes the requirement that persons in charge of ports and terminals provide garbage reception facilities as required by regulation and the authority to deny entry of a ship to a port or terminal required by regulations to provide

those reception facilities if the port or terminal is not in compliance with those regulations.

We believe this is necessary to insure that reception facilities would in fact be available at ports or terminals as required.

Furthermore, no Federal agency should be required to provide or arrange for these reception facilities, nor should the Federal Government shoulder the cost of augmenting them. At present, the Secretary of Agriculture regulates certain types of garbage entering the United States, and representatives of that department have previously advised that they anticipate reception facility voids being filled by private industry.

Mr. Chairman, it is essential that the implementing legislation for Annex V provide the flexibility necessary for enforcement and compliance. Again, the voluntary international guidelines which we are preparing with other governments at IMO will describe additional measures to assist in effective enforcement of the annex. These guidelines will cover not only enforcement but also education of the public and engineering measures.

To borrow a line from our friends at the New Jersey Department of Environmental Protection, these are the three elements in the solution to the trash and garbage problem: engineering; education; and enforcement, the three Es.

As to the coverage of public vessels, our proposal does not alter the approach currently taken in section 3(d) of APPS which essentially provides that public vessels so far as is reasonable and practicable without impairing their operations or operational capabilities act in a manner consistent with MARPOL, which would include Annex V when it is entered into force.

In closing, Mr. Chairman, I want to emphasize that the Coast Guard, being a seagoing service with law enforcement responsibilities, is especially aware of the difficulties of enforcement of the Annex V provisions at sea. Enforcement will not be easy; however, the approach being sought by this administration offers the best opportunity and flexibility to facilitate essential international cooperation in addition to providing full protection to the U.S. coastline.

I ask your support for early ratification and passage of the administration's legislative proposal to implement the provisions of Annex V. Mr. Chairman, we sincerely would be pleased to work with your committee on suggested implementing language or other matters related to Annex V, and I would be pleased to answer any questions that you or the committee may have.

Thank you, sir.

[The questions and answers follow:]

QUESTIONS OF THE CHAIRMAN AND THE ANSWERS

Question. In what percentage of cases was the evidence provided by the U.S. considered to be sufficient for the flag states to assess penalties?

Answer. It is assumed that the question concerns offshore violations of the discharge limitations of Annex I of the International Convention for the Prevention of Pollution from Ships 1973, as modified by the protocol of 1978 (MARPOL 73/78). There were 28 cases of suspected discharge violations that were forwarded to foreign flag states signatory to Annex I for further investigation. Four of these cases have been forwarded recently and may result in the assessment of a penalty by the flag state in the future. It is noted that in one case a violation was found but no penalty

was assessed by the flag state due to prompt containment and clean-up actions by the vessels master. The expense of these actions was approximately $73,000 U.S. Out of the 24 remaining cases that have been forwarded to foreign flag states the U.S. has received reports of 6 cases where penalties have been assessed. Therefore, the percentage of cases forwarded to flag states that have been assessed penalties is 25%.

However, we have reviewed the cases forwarded to flag states for discharge violations and have determined that 16 of the cases or about 57% contained evidence that we would consider sufficient to process the case under Coast Guard civil penalty procedures if the case had occurred under the jurisdiction of the U.S. Without including the four most recent cases, for which there has not been sufficient time to receive penalty information, the ratio of penalties assessed by the flag states to cases considered to have sufficient evidence under U.S. Law is 4/12 or about 33%. In two cases reviewed we did not feel that there was sufficient evidence to process the case under the Coast Guard civil penalty system; however, the cases were assessed penalties by the flag state.

It should be noted that violation under Coast Guard civil penalty procedures does not guarantee that a penalty will be assessed. The ultimate decision on the assessment of a penalty lies with the Coast Guard Hearing Officer who decides the case based on the evidence presented by the parties involved.

Question. What is the average size of the penalty levied by foreign flag states for violations cited by the U.S.?

Answer. It is assumed that the question concerns offshore violations of the discharge limitations of Annex I of the International Convention for the Prevention of Pollution from Ships 1973, as modified by the protocol of 1978 (MARPOL 73/78). The average penalty levied by foreign flag states is equivalent to approximately $1425 U.S.

There were 6 cases forwarded to flag states that resulted in the assessment of penalties. In two of the cases the amount of penalty assessed was not reported to the U.S. and therefore, these two cases were not included in the penalty average calculations.

Question. What is the average size of the penalty levied by the U.S. against U.S. flag vessels for Annex I violations?

Answer. It is assumed that the question concerns offshore violations of the discharge limitations of Annex I of the International Convention for the Prevention of Pollution from Ships 1973, as modified by the protocol of 1978 (MARPOL 73/78). To date there has been only one Annex I discharge violation case of a U.S. vessel with evidence considered sufficient to process a penalty under Coast Guard civil penalty proceedings and to receive a penalty. The penalty assessed was $450 U.S. (See attached listing)

SUSPECTED ANNEX I ILLEGAL OIL DISCHARGE SURVEILLANCE STATISTICS 1983–1987

1. Total cases initiated by vessel sightings	125	
2. Cases where suspected vessels were positively identified and were capable of being investigated further.	99	
3. Cases where suspected vessels flag states were signatory to the MARPOL 73/78 Convention.	64	
4. Cases where suspected vessels flag states were signatory to the MARPOL 73/78 Convention and were forwarded to the flag state. For percentages the 4 cases that are pending/active are not included since they may be assessed penalties.	28 —4 24	44% of suspected signatory vessels.
5. Cases forwarded to flag states that would be considered by Coast Guard Investigators to have sufficient evidence to process under Coast Guard civil penalty proceedings.	16	57% of cases forwarded to flag states.

SUSPECTED ANNEX I ILLEGAL OIL DISCHARGE SURVEILLANCE STATISTICS 1983–1987—Continued

6. Cases forwarded to flag states that resulted in penalties and were reported to the U.S. In one case reported, a violation was found but no penalty was assessed due to clean up and repair related costs that amounted to over $72,000 U.S. In two cases that were reviewed the U.S.C.G. Investigating Officers did not feel that there was sufficient evidence to process the case under the Coast Guard civil penalty system. However, these cases were eventually assessed penalties by the flag state. 4 cases are still considered active and may be assessed penalties.		6	9% of Total Signatory Cases.... 25% of Total Cases forwarded to flag states
7. Total amount fo penalties assessed by flag states. (4 Cases) In two of the six penalty cases the amount of the assessed penalty was not reported.	$5,700 U.S.		.....
8. Average penalty assessed by flag states. (4 Cases) In two of the six cases the amount of the assessed penalty was not reported.	$1,425 U.S.		.....
9. Cases where suspected vessels were U.S. registered.		12	.....
10. Cases where U.S. vessels were assessed a penalty. To date there has been only one Annex I discharge violation case of a U.S. vessel with sufficient evidence to process under Coast Guard civil penalty proceedings and to receive a penalty. The vessel reported the discharge itself. The penalty assessed was $450 U.S. Therefore, the average U.S. penalty is $450.		1	8% of the U.S. vessels suspected assessed penalties.

Question. Admiral, let me begin by congratulating you and the Coast Guard for your actions to have the Gulf of Mexico designated a special area under this convention. I also appreciate your cooperation with the Center for Environmental Education in developing the scientific evidence which will help persuade other nations to make such a desigantion.

In answer to a question I submitted at our hearing on April 8, Admiral Yost responded that the CEE study "should provide adequate scientific documentation to show why the Gulf of Mexico should be considered a special area. Therefore, no additional studies by the U.S. Government are anticipated at this time."

Is that still the Coast Guard view?

Answer. First, let me clarify that it is premature at this point to say that the U.S. should go forward with a recommendation at the International Maritime Organization to designate the Gulf of Mexico a Special Area under Annex V. The jury is still out. However, the Coast Guard is actively pursuing whether such a designation should be made. Now returning to your specific question, the answer is yes. We are hopeful, and indeed anticipate, that the information resulting from the CEE study will suffice to allow for a determination on this matter in the near future. The Coast Guard has just received a draft of the study, which at first glance appears to be fairly comprehensive; and we are digesting its contents.

Question. Do you need any resources or other encouragement to do any additional research on the Gulf of Mexico?

Answer. Again, we do not anticipate the need for additional research to make a determination on whether the Gulf of Mexico should be designated a Special Area. I would point out, however, that garbage pollution in the marine environment is a dynamic problem. Research should always be ongoing in both the Gulf of Mexico and on a worldwide basis to assist us in gaining a better handle on the sources of marine debris, and evaluating the effectiveness of Annex V provisions after its entry into force and whether additional measures are needed. For example, if it is

found that the evidence is insufficient to support the designation of the Gulf of Mexico as a Special Area at this time, research should continue to help us evalaute whether the "regular" Annex V measures are doing the job.

Question. How do you foresee the timetable and prospects for approval of the designation for the Gulf?

Answer. As I stated previously, this matter is under active consideration. Aside from examining the results of the CEE study, we must consult with a variety of federal, state and private industry representatives who have an interest or would be affected by a Special Area designation. Designation of the Gulf of Mexico as a Special Area under Annex V would require an amendment to that Annex. The articles of the Convention prohibit amending an Annex prior to its entry into force. If the determination is made in the U.S. to seek approval of the designation at the International Maritime Organization, we would seek approval, using the Convention's tacit amendment procedure. Under the tacit amendment procedure, the proposed amendment is circulated to all members of IMO and all parties of MARPOL at least six months prior to its consideration. Following favorable consideration by Parties to MARPOL, the amendment is deemed to have been accepted at the end of a ten month period, unless during that period an objection is communicated to IMO by one-third of the Parties or by the Parties which constitute fifty percent of the gross tonnage of the world's merchant fleet. The amendment will enter into force six months after the date that it is accepted. Because we are only in the preliminary stages as far as process is concerned, it is difficult to assess how much support we would receive from the international community.

Senator BREAUX. Thank you very much, Admiral, for your testimony. We will have questions, but now we will take Dr. Ronald Caffey.

Dr. CAFFEY. Thank you, Mr. Chairman. I am Ronald Caffey, Assistant to the Deputy Administrator, Plant Protection and Quarantine, Animal and Plant Health Inspection Service, U.S. Department of Agriculture.

Mr. Chairman and members of the committee, it is a pleasure to appear before you today to discuss plastic pollution in the marine environment and implementation of Annex V of the protocol relating to the International Convention for the Prevention of Pollution from Ships. Annex V prohibits, with limited exceptions, the disposal of all plastics from ships into the sea. It also restricts the discharge at sea of other types of garbage to specified distances from the nearest land.

The Department of Agriculture recognizes that the disposal of plastics at sea creates serious problems with beach pollution and threatens marine life and other wildlife. We support ratification of Annex V to protect these important areas of the environment but defer to the Department of Transportation regarding the appropriate legislative mechanism for doing so.

The Department's Animal and Plant Health Inspection Service regulates garbage to prevent the entry of exotic agricultural pests and diseases into the United States. Garbage from international movement of passengers and carriers has been found to be the agent by which foreign pests and diseases have entered unaffected countries.

There is reason to be concerned that garbage and material that comes into contact with garbage could be the source of an infestation or infection that could be devastating to American agriculture. The regulation of garbage of foreign origin is a vital part of our ongoing effort to protect American agriculture.

We regulate garbage carried by vessels if the vessel has visited a foreign country other than Canada. In Fiscal Year 1986 such vessels made 74,000 calls at U.S. ports. APHIS boarded more than

47,000 of these vessels to determine compliance with our regulations. Our regulations define garbage in part as "waste material derived in whole or in part from fruits, vegetables, meats or other plant or animal material and other refuse of any character whatsoever associated with any such material on board any means of conveyance".

Under the regulations, garbage must be kept in tightly covered, leakproof containers while within the territorial waters or otherwise within the United States or be offloaded and disposed of under USDA direction and supervision. Disposal generally must be be incineration, sterilization, or grinding into an approved sewage system at a USDA approved facility.

Currently 32 ports have facilities that are approved to handle garbage under our regulations. We do not have regulations regarding the movement of trash into the country if the trash has never come in contact with garbage, nor do we regulate garbage on vessels that only move between continental United States ports or between continental U.S. ports and Canadian ports.

We emphasize that our authorities are based on and limited to biological issues, in this case the prevention of the entry of exotic agricultural pests and diseases. Our current authorities have proved adequate to enable us to protect animal and plant health in the U.S. from the biological risks posed by foreign garbage. We feel it is important to maintain this effort to insure the continued health of America's agricultural resources.

This concludes my prepared statement. I would be happy to respond to any questions

[The following information was subsequently received for the record:]

U.S. DEPARTMENT OF AGRICULTURE,
ANIMAL AND PLANT HEALTH INSPECTION SERVICE,
Washington, DC, August 24, 1987.

Hon. ERNEST F. HOLLINGS,
Chairman, Committee on Commerce, Science, and Transportation,
U.S. Senate, Washington, DC. 20510.

DEAR MR. CHAIRMAN: We were pleased to appear before your Committee and the National Ocean Policy Study on July 29, 1987, to present testimony on implementation of Annex V of the MARPOL Convention. We are also pleased to answer Senator Bentsen's questions on this issue.

As we said in our testimony, the Department of Agriculture (USDA) recognizes that the disposal of plastics at sea creates serious problems for marine life and other wildlife, and we support ratification of Annex V to protect these important areas of the environment.

The Department's Animal and Plant Health Inspection Service (APHIS) regulates garbage to prevent the entry of exotic agricultural pests and diseases into the United States. Garbage carried by vessels is regulated only if the vessel has visited a foreign port other than Canada. Plastic waste is not regulated unless it has come into contact with waste material derived in whole or in part from fruits, vegetables, meats, or other plant or animal material. Since our mission is purely biological—to protect American agriculture by preventing the entry of exotic pests and disease organisms—we believe that enforcement of Annex V of MARPOL is properly placed within the jurisdiction of the United States Coast Guard. Where consistent with our mission and current activities, however, we would be pleased to cooperate with the Coast Guard in any way we can.

APHIS currently has offices and personnel at 57 maritime ports of entry. Additional smaller ports are provided service on an as-needed basis. In Fiscal Year 1986, 286.5 staff years were expended on all maritime activities. Sixty-two of those staff years were from reimbursible overtime activities. The number of staff years devoted to ship inspections alone is not maintained separately, although we estimate that

ship inspections require about 25 percent of the total staff years for all maritime activities.

During a boarding inspection, our inspector first discusses with the master or officer in charge of the vessel general agriculture concerns, which include proper garbage handling, the nature of cargo or dunnage to be discharged, and the vessel's itinerary. After this discussion, food stores lockers and garbage handling and storage both inside the vessel and on its deck are inspected. We inspect garbage to verify that it is stored in closed, leakproof containers inside the rail of the vessel. If the garbage is offloaded, it must be disposed of according to USDA regulations, which require incineration, sterilization, or grinding in an approved facility. Based on a vessel's past history or itinerary, it may also be necessary to conduct a cargo area inspection.

Since we do not know the magnitude of the problem with dumping plastic waste at sea, we have no way of estimating what kind of resources would be needed for any agency to implement Annex V. Resources needs would depend on the magnitude of the problem and the type of enforcement scheme contemplated.

Please let us know if we can provide any further information.

Sincerely,

BERT W. HAWKINS, *Administrator.*

Senator BREAUX. Thank you very much, Dr. Caffey.

Next, Mr. Larry Koss.

Mr. Koss.

Mr. Koss. Good morning, Mr. Chairman.

We agree in principle with the need to prevent pollution of our oceans. We have a solid pollution abatement program and try to the best of our ability to prevent pollution of the oceans and coastal waters. The program includes research and development as well as acquisition and installation of equipment aboard ship.

In your letter of 14 July inviting the Navy to participate in this hearing, you asked that we discuss the Navy's practice regarding the disposal of plastic waste at sea and what steps we are taking to reduce plastic debris in the marine environment. You also solicited our views concerning the feasibility of segregating organic and inorganic garbage using equipment like compactors on naval vessels.

Dealing with the latter issue first, it is standard shipboard practice to separate organic garbage, that is food waste, from inorganic garbage, solid waste. Organic garbage in the galley and scullery areas aboard ship is collected and fed into special Navy-developed food waste pulpers.

The organic waste is discharged overboard via the pulper when the ship is at sea beyond three miles of shore and into the ship's sewage holding tanks when the ship is within three miles of shore. This is in accordance with U.S. regulations and Annex V.

Solid inorganic waste is collected and discharged overboard daily when the ship is at sea; however, the Navy has recognized for many years the need to reduce the discharge of floatable solid waste at sea, particularly the need to eliminate waste material from washing up on the beach. That is why we established discharge regulations many years ago prohibiting our ships from discharging unpulped solid waste within 25 miles of shore. This is more restrictive of current U.S. regulations, which prohibits waste material discharge within three miles, and more restrictive than Annex V, which permits the discharge of sinkable waste beyond 12 miles.

Navy regulations also require shipboard personnel to attempt to package the waste so that it sinks, but that is an extremely diffi-

cult task without a trash compactor, to compress the waste so it has a density greater than seawater.

Recognizing the need to provide our ships with equipment to pulp or incinerate or compress the solid waste generated daily, we have reviewed, tested and evaluated just about every type and design of equipment, including shredders, pulpers, compactors and incinerators. There are no commercially available products which will work aboard ship and meet our stringent operation and maintenance criteria for reliability, maintainability and safety and at the same time satisfy shipboard space and weight constraints.

That is why we have been working in our research laboratory to develop equipment suitable for application aboard war ships; for example, the special food waste pulper I mentioned earlier.

We are also developing in our laboratory a specially designed solid waste pulper and solid waste compactor. The development of such equipment is necessary for a number of reasons; i.e., to reduce the volume of waste aboard ship to a more manageable level when it cannot be discharged overboard, and to cause the waste to sink when waste is discharged at sea beyond 25 miles from shore.

The pulper and compactor that are under development reflect years of research, test and evaluation with similar types of equipment in our laboratory. This equipment has been designed from scratch for the rigors of the shipboard environment with emphasis on reliability, maintainability, simplicity and safety of the people operating the equipment.

The compactor should complete shipboard test and evaluation and be ready for production by 1990 and the pulper by 1992.

Regarding our procedure for the disposal of plastics at sea, the provision in Annex V prohibiting the discharge of plastic material at sea presents a major problem for us. At this time, it is not possible to comply with this prohibition. Plastic materials are widely used throughout the ship as it is throughout the home or marketplace or workplace. Plastic waste is mixed with all of this solid waste aboard ship and discharged overboard at sea, which is standard practice throughout the marine industry.

However, while commercial maritime ships at sea for long periods should be able to comply with the discharge prohibitions because they have very few people per ship and have large ships, Navy ships have crews ranging from several hundred to several thousand and are equivalent or smaller in size.

Additionally, Navy ships are packed with equipment, leaving little room for personnel, much less room to store plastic waste. Moreover, storage of plastic waste for any length of time would create fire and safety hazards and would have a negative effect on ship's mission, crew morale and health and sanitation conditions.

Because of these concerns, waste materials are not permitted to accumulate aboard ship. Rather, it is removed from each space several times a day. The training, the drills and maintenance evolutions by ships personnel are very demanding, and accumulation of waste material would have a severe negative impact on these and similar operational readiness requirements.

Because plastic waste is entrained in the flow of solid waste aboard ship, segregation is very difficult. Even if it were possible to collect the plastic, there is no place inside or outside the ship to

store it without penalizing the ship and its crew and assuming unacceptable risks.

The solution in the long term lies with the development of equipment to install aboard ship to handle the waste and the reduction of plastic brought aboard ship.

Regarding new equipment developments, the concept of a thermal destruction compaction device to reduce plastic material aboard ship to a form which can be stored and discharged so that it sinks holds the most promise for dealing with the plastics problem. We intend to initiate a research and development project next year into the development of a thermal compaction device with the ultimate goal of producing such shipboard equipment.

To reduce the amount of plastic material brought aboard ship, we are reviewing the feasibility of using changes in procurement policy, particularly with regard to packaging. Progress with this approach is constrained by a number of considerations which are discussed in my written statement.

This concludes my oral statement. I thank you for the opportunity to present our position. I will be pleased to answer any questions you may have, sir.

[The following information was subsequently received for the record:]

QUESTIONS OF SENATOR BENTSEN AND THE ANSWERS

Question: What is the practice of other Navies with regard to MARPOL restrictions?

Answer: Other NATO Navies recognize that they have an exemption from compliance with MARPOL regulations. However, they also recognize that it is in their best interest to attempt to comply because of the concerns about public image, international relations, politcal repercussions vis-a-vis WARSAW BLOCK nations, and the environment. They use the guidelines embodied in the MARPOL Convention which states "that each party shall ensure by the adoption of appropriate measures not impairing the operations or operational capabilities of such ships owned or operated by it, that such ships act in a manner consistent, so far as is reasonable and practical, with the present convention."

In a practical sense, the above translates into a Naval policy for nearly all nations which requires that all new ships be constructed with a full range of the latest pollution abatement equipment to handle sewage, oily waste, and solid waste. The issue of backfit of existing ships is a more complicated matter involving such factors as type of pollution problems to be resolved, age of the ship, and which ships are more involved with foreign travel being balanced against funding available for the procurement and installation of the ship alterations. It is fair to say that nearly all nations prioritize their approach to ship alterations. Oily waste pollution abatement ship alterations are to be accomplished first with sewage and solid waste ranked thereafter. Newly constructed active fleet ships receive ship alterations before older ships. Certain older ship classes may never get the Shipalt installation accomplished depending on budget constraints.

In summary, it is difficult to generalize policies of many nations, particularly in such a dynamic area. However, all Navies are attempting to comply so far as is reasonable and practical recognizing the MARPOL Convention was established to regulate ships that are quite different from Naval ships.

Question: Do you have any information on the extent to which they may comply with Annex V?

Answer: The NATO nations whose ships have operational scenarios similiar to ours will have the same problems that we have in attempting to comply at this time. For example, Canada, France, Italy, and the United Kingdom have ships which have long deployments and are of similar design with no available storage space and densely populated with relatively high volumes of solid waste generated daily. On these ships segregation of plastic waste and storage of the waste is not feasible given the risks in terms of safety, health, and degraded mission performance.

Other nations such as Norway, Denmark, and the Netherlands which have much smaller warships with smaller crews, and shorter deployments, generate substantially less volume per day. The plastics problem is more manageable for them because of the smaller volume of waste generated and relatively short deployments making it more feasible to try to return plastics ashore.

It is difficult to generalize about the types of solid waste handling equipment used by each nation but some use either a compactor, incinerator, or shredder to help handle solid waste. While these equipments are not ideal for dealing with plastics, they have greater utility for those ships which have small crews and short deployments. For those nations whose ships have large crews and long deployments, solid waste and plastics are not manageable without the development and installation of new equipment specially designed for warships because of the cumulative volumes of waste generated.

Question: What will the U.S. Navy do in special areas like the Mediterranean, where no solid waste dumping is supposed to be done?

Answer: The prohibition against the discharge of solid waste in special areas is reasonable for the typical maritime ship which has a small crew and generates relatively little solid waste per day and also travels point to point with short deployment periods. The prohibition was not meant to apply to Naval ships because they are designed and operated differently. That is one of the reasons for the exemption for Naval ships in the MARPOL PROTOCOL.

It is not possible to destroy the solid waste nor is it possible to store the waste aboard ship during routine ship operations. The best that we can do is to package the solid waste so that it is negatively bouyant when discharged overboard. We are in the final stages of the development of a specially designed compactor that will enable shipboard personnel to compress solid waste into slugs that will sink, thus eliminating floatable waste. If the compactor successfully passes through the shipboard test and evaluation process, equipment installation aboard ship can begin in FY-92.

The objective of Annex V is to prohibit the indiscriminate discharge of solid floatable waste to protect the environment, to improve the water quality and improve the esthetic quality of life. Packaging the solid waste aboard ship so that it sinks essentially fulfills this objective. Moreover, when Annex V was developed, feasible alternatives to a no-discharge policy to protect the special areas did not exist. Since that time, the technology base has been broadened and advanced so that equipment such as the Navy compactor can be developed to offer practical alternatives to the no-discharge policy.

Senator BREAUX. Thank you very much.

Dr. Davies.

Dr. DAVIES. Thank you. I am Tudor Davies. I am the Director of the Office of Marine and Estuarine Protection of the EPA, and my office is charged with the implementation of the Ocean Dumping Act which applies to the transportation of materials for the purpose of ocean dumping.

The Marine Protection Research and Sanctuaries Act, among other things, serves to implement the London Dumping Convention, an international treaty to which the U.S. is a signatory.

Annex I of the Convention essentially prohibits the ocean dumping of persistent plastics or synthetic materials which may float or remain in suspension so as to materially interfere with the legitimate use of the sea.

Consistent with that provision, the agency does not issue permits authorizing the transportation of plastic materials for the purpose of ocean dumping. Since enactment of the Ocean Dumping Act, there has been a major decline in the number of industrial waste dumpers and the amount of industrial waste being dumped.

While there has also been a decline in the number of sewage sludge dumpers, the actual volume being dumped increased due to improvements in sewage treatment facilities, although over the last several years the dumping volume has remained relatively constant.

The sewage sludge ocean dumping which is now taking place is limited to New York and New Jersey municipalities and is taking place pursuant to court orders.

We do not believe that the transportation of materials for purpose of ocean dumping results in significant contribution to the presence of plastics in the ocean off the United States. However, plastics are virtually ubiquitous materials in our modern society and can find their way into the marine environment from a number of other sources, such as disposal of waste generated by the operation of vessels, accidental loss, recreational vessels and nonmarine sources such as storm water runoff in some urban areas.

Most plastic materials as currently manufactured do not degrade over time, and they persist in nearly intact form for decades or longer.

Aside from the aesthetic problems resulting from the presence of such plastics in the marine environment, these materials can cause serious injury or death to marine life due to ingestion or entanglement.

We are thus seriously concerned about the adverse effect which plastic debris can have on our marine environment and have recently participated in several activities. EPA commissioned a study to investigate the issues. We have participated in symposia, international meetings and in the NOAA Marine Debris Roundtable.

EPA believes that consideration should be given to the use of alternative types of plastics. Bio or photodegradable plastics pose a lesser risk to the environment following disposal because over time they will break down rather than persist for decades.

There are a lot of things we do not know about the dimensions of the plastic debris problem and the effect of various approaches to

address it. We will be initiating a study to look at technical issues to address problems caused by plastic debris.

I would like to say that EPA supports the entry into force of Annex V of MARPOL and welcomes Senate action on this.

This concludes my testimony.

[The statement follows:]

STATEMENT OF DR. TUDOR T. DAVIES, DIRECTOR, OFFICE OF MARINE AND ESTUARINE PROTECTION, ENVIRONMENTAL PROTECTION AGENCY

I am Tudor T. Davies, Director of the Office of Marine and Estuarine Protection of the U.S. Environmental Protection Agency. It is a pleasure to be here today to testify before you on the issue of plastic debris in the marine environment. I would like to briefly highlight the Agency's activities on this important environmental issue and our views on what might be done next to control this problem.

The Office of Marine and Estuarine Protection is the Agency office charged with implementaiton of the Ocean Dumping Act, which applies to the transportation of materials for the purpose of ocean dumping. Within the authority of that act we have taken a number of steps to prevent the transportation of plastic materials for purposes of ocean dumping, as I will briefly summarize.

The Ocean Dumping Act, among other things, serves to implement the London Dumping Convention, an international treaty to which the U.S. is a signatory. Annex I of the London Dumping Convention essentially prohibits the ocean synthetic materials which may float or remain in suspension so as to materially interfere with legitimate uses of the sea. Consistent with that provision, the agency does not issue permits authorizing the transportation of plastic materials for the purpose of ocean dumping.

Where violations of the Ocean Dumping Act are discovered, the Agency brings appropriate enforcement actions. This has included a 1985 administration enforcement action for the dumping of plastic material in violation of the act which resulted in a fine of $81,000.

Since enactment of the Ocean Dumping Act, there has been a major decline in the number of industrial waste dumpers and the amount of industrial waste being dumped. While there also has been a decline in the number of sewage sludge dumpers, the actual volume being dumped increased due to improvements in sewage treatment facilities, although over the last several years the dumping volume has remained relatively level. The sewage sludge ocean dumping which is now taking place is limited to New York and New Jersey municipalities and is taking place pursuant to court orders.

Where materials which have received Ocean Dumping Act permits may incidentally contain plastics, the permit terms prohibit the disposal of plastics. The sewage sludge dumping permit terms, which essentially remain effective under the court orders now authorizing such dumping, contain a specific prohibition against disposal of floatable plastics. Our Region II Office has been investigating the barges prior to ocean dumping to assure that this requirement is met.

We thus do not believe that transportation of materials for purposes of ocean dumping results in a significant contribution to the presence of plastics in the oceans off the United States. However, plastics are a virtually ubiquitous material in our modern society and can find their way into the marine environment from a number of other sources, such as disposal of wastes generated by the operation of vessels, accidental loss, recreational vessels, and non-marine sources such as storm water run-off in urban areas. For example, it has been estimated that as many as 639,000 plastic containers per day are disposed of worldwide by ships.

Most plastic materials, as currently manufactured, do not degrade over time and may persist in nearly intact form for decades or longer. Aside from the aesthetic problems resulting from the presence of such plastics in the marine environment, these materials can cause serious injury or death to marine life due to ingestion or entanglement. Although it is difficult to accurately estimate the number of marine mammals and birds killed each year by plastic trash (including abandoned or lost fishing gear), researchers estimate that hundreds of thousands of marine mammals and birds die each year because they entangled in or ingest plastic materials.

We thus are seriously concerned about the adverse effects which plastic debris can have on our marine environment, and have recently participated in several activities to address and study the problems caused by plastic debris in the marine environment:

EPA recently commissioned a study to investigate the issues and problems associated with plastic debris in the marine environment;

EPA has participated in national symposiums and workshops addressing the problems and issues associated with plastic debris;

EPA representatives participate in international meetings, such as consultative meetings under the London Dumping Convention, at which the international aspects of plastic debris in the marine environment are addressed;

EPA participates in the marine debris roundtable, which was organized by the national oceanic and atmospheric administration (NOAA), and plans to organize and host the roundtable's third meeting in early 1988.

EPA believes that consideration should be given to the use of alternative types of plastics. Bio- or photo-degradable plastics pose a lesser risk to the environment following disposal because, over time, they will break down rather than persist for decades. There are a lot of things we do not know about the dimensions of the plastic debris problem and the effect of various approaches to address it. We will be initiating a study to look at technical issues to address problems caused by plastic debris.

EPA supports the entry into force of Annex V of MARPOL. That annex has been transmitted to the Senate for its advice and consent, and we urge favorable action. Following this, we believe the U.S. should encourage other nations to become parties to that annex so that Annex V of MARPOL may enter into force.

That annex would generally prohibit the disposal of plastic wastes generated during the normal operation of vessels. Its entry into force could be a significant step in eliminating this potentially significant source of plastics in the marine environment. Studies of plastics in the marine environment indicate that the types of materials often found in the marine environment (e.g., plastic sheets, strapping bands) are of a type which appear to be associated with disposal activities from vessel operations. The entry into force of Annex V of MARPOL would provide a scheme under which to control such activities, and because of its international scope, would have much more impact on the overall ocean environment than domestic action by the U.S. alone.

This concludes my testimony, and I would be happy to answer any questions which the committee might have on the topics addressed in my testimony.

Senator BREAUX. Thank you very much, gentlemen, for all your presentations.

Mr. Douglas, let me ask you first, how much of a problem is the entry of plastics into the marine environment to fisheries? Has anybody looked at it from the standpoint of saying it is serious, not serious or potentially serious?

Mr. DOUGLAS. Mr. Chairman, we have looked at it very extensively.

Let me distinguish between two things, one thing which we know and one thing which we do not know. We are able to determine where plastics have been a problem to various mammals, fisheries, and sea birds. We have indications of the effect, but what we have been unable to determine is the extent of it and how it relates to being a problem to the health of the stocks.

That is primarily because our interception of the animals that have had a plastics problem generally are strandings on a beach or somewhere like that and not everywhere they roam. We have been unable to sample everywhere these animals roam to find out the extent of this plastic problem. So we know the problem is there. We are unable to quantify it.

Senator BREAUX. Can you give us a comparison on the difference of the problem with regard to disposable containers or plastic bottles versus the problem of monofilament nets, plastic nets used in fishing as a potential problem when they get released?

Mr. DOUGLAS. Mr. Chairman, Mr. Coe, who is my program manager who deals in all of these data and statistics, has been so kind to travel from Seattle every time, and we have not been able to let him speak a word. So let me ask him to answer that. He does have

the information and is conversant with the precise details, so this is Mr. Coe from Seattle, sir.

Senator BREAUX. And he speaks.

Mr. COE. Mr. Chairman, thank you. It is a pleasure to be here.

There is a considerable difference in the impacts on marine resources and wildlife resulting from the loss of monofilament fishing nets, drift nets I suspect you are referring to, and other containers, bottles and plastic general domestic waste from ships and from on shore. At least that is in the initial sense, in that drift nets are made for the purpose of entangling marine life of various sizes and are known to take both directly and indirectly numbers of marine mammals and sea birds.

As Mr. Douglas has stated, we do not have a complete record of the statistical impact of these incidental takes or indirect takes.

Senator BREAUX. I take it that nothing in Annex V or any additional legislation that is pending would be aimed at regulation of the use of monofilament nets in any way? Annex V would not touch that, would it?

Mr. COE. It is my understanding that Annex V will not restrict the use of any types of fishing gear; however, it will prohibit the discard of waste fishing gear or fragments thereof.

Senator BREAUX. That would be plastic?

Mr. COE. That would be plastic, yes. Almost all modern fishing gear is plastic, sir.

Senator BREAUX. Mr. Douglas, you mentioned the Society of Plastics Industry having sponsored a national symposium here in Washington on research and development and marketing of controlled lifetime plastics, degradable plastics.

We have the plastic folks coming up and they will talk about that, but from your perspective is progress being made in the area of developing plastics that are degradable?

Mr. DOUGLAS. I think it is. Mr. Coe was in those meetings, so I am going to turn to him again for a little more detail on that, Mr. Chairman.

Mr. COE. Mr. Chairman, the results of the Society of the Plastics Industry-sponsored meeting from my perspective, which is certainly not that from a polymer chemist or a marketing specialist in plastics, is that there are significant opportunities to develop the issue of controlled lifetime plastics technology, and there are certainly some applications that make sense.

I was particularly impressed at these meetings with the vitality in the plastics industry with regard to this issue. I think things are progressing technically.

Senator BREAUX. Mr. Douglas?

Mr. DOUGLAS. Mr. Chairman, let me add one thing. From my point of view, I would caution that although I think this technology, as Mr. Coe says, has great opportunity here and possibilities, I would not want it to be a substitute for the proper handling of plastics, whether or not they are degradable. I think we really have to focus on handling of plastics as well as biodegradability.

Senator BREAUX. Admiral, from the Coast Guard's perspective on the nature of the problem, we have literally thousands of smaller vessels, and a lot fewer large vessels.

77-985 O - 87 - 2

Is the problem more quantitatively serious on the large vessels versus the large number of smaller vessels? I am looking at it from an enforcement standpoint. Obviously it is going to be more difficult to regulate thousands and thousands of smaller vessels versus fewer numbers of larger vessels.

From an enforcement standpoint, is it easier just to go after the larger vessels and hope that you take care of most of the problem by addressing the larger size vessels?

Admiral KIME. No, Mr. Chairman. I think we have to also look at the smaller vessels, too. Unlike the other annexes, I and II, I for oil and II for hazardous materials which only apply to seagoing tankers, Annex V applies to all vessels, because all vessels generate the materials that go into the ocean.

I think that the amount that goes in is going to be proportional to, number one, the number of people, and, number two, it is going to be proportional to how much dunnage, plastic wrappers, et cetera, that would be aboard the vessels.

I think the key to the enforcement is manyfold. I think an important aspect is education. Just as we have learned from attacking the litter problem on our highways, it is much the same.

I think an international effort is under way, and I think the guidelines that I mentioned will help further that a great deal. I think that we have to be very careful on how we approach the reception facility problem. The Port of Miami, for instance, with 30-odd crew ships coming in, has addressed this. They have an incinerator there to burn everything.

We have many fishing ports along the coast of Alaska, the coast of Louisiana, other places where it has to be addressed a bit differently, and that is why we have asked for flexibility. But in providing reception facilities and in areas where we would have to issue a certificate of adequacy for a port, perhaps in a major port we need a certificate of adequacy to say it has enough reception facility capability.

In a small port, a fishing port, maybe a Dempster dumpster is all that is required. Certainly if the foodstuffs do not come aboard from a foreign country, they could be dumped in the Dempster dumpster just as if they had been generated in the restaurant in the marina.

We are looking for that type of flexibility.

Senator BREAUX. With regard to the plastics, if Annex V says do not dump plastics at sea, what about some kind of a regulation which would say if you are not going to dump in that sea do not take them to sea, attacking the problem from the port of departure as opposed to when it comes back in?

I realize that that would probably be a problem because many goods that are used aboard ship perhaps do not come except in plastic containers, but if that were a requirement I would imagine that industry would adjust and produce paper containers in lieu of plastic containers.

Admiral KIME. I think that is an avenue that should be approached, to minimize the amount of plastic that goes aboard ships. That is what we are trying to do aboard our own ships.

However, I think the marine market——

Senator BREAUX. You say you are trying to do that. Does the Navy or the Coast Guard when you request provisions actually suggest that you would like to have them in nonplastic containers, or is that just an idea?

Admiral KIME. We have provided information to our commanding officers to try to minimize this. We are not requiring this; however, we have required at least aboard Coast Guard vessels in our shipboard regulations that they comply with the provisions of Annex V as written at the present time.

To get back to the issue that you questioned me about, certainly I think all effort ought to be made to minimize the amount of plastic that goes aboard ship from the supply side. I think, however, that the percentage of materials that are consumed aboard ship is very small compared with the percentage of similar materials that are consumed around the rest of the country; therefore, it is going to be very difficult for the marine industry to influence the packaging industry in a great amount initially.

We do think, however, that an effort should be made to pursue this effort that you mentioned, but I think at this time we would stop short of endorsing a total prohibition of bringing plastics aboard ship. I do not think practically that can be done right now.

Senator BREAUX. In your testimony, you mentioned with regard to legislation that the committee is working on, you recommended that the legislation not be a freestanding bill but that it be an amendment to Title 33 of the U.S. Code, the APPS legislation, implementing legislation that we have prepared would implement Annex V through an amendment to APPS.

I do not think we have received suggested legislation from the administration yet, have we?

Admiral KIME. Mr. Chairman, we had submitted this on July 22. It has been forwarded to the president of the Senate and Speaker of the House by Mrs. Dole. In addition, our people have been working in providing drafting assistance to this committee, and I believe your staff in fact sometime prior to that did have access to something very close to what we——

Senator BREAUX. Okay. I have not seen it yet, but you are recommending we just do it as an amendment?

Admiral KIME. Yes, sir. I think there are many aspects that have to be taken into account. One obviously is to provide for future amendments. APPS does that. Most of the freestanding legislation we have seen does not do that.

There are other things such as penalties, et cetera.

Also, from purely an administrative point of view, it makes it much easier for us who have to administer this to have it contained in the same piece of legislation that applies to the other annexes, and certainly it would be more certain that we do not let something slide through the crack when future amendments are made.

Senator BREAUX. Dr. Caffey, your boys go on board the ships and then check when they call on the port. You said that 74,000 ships called on U.S. ports last year and you all boarded 47,000.

I get the impression that an awful lot of garbage just goes over the stern when the ship is at sea, crew ships and Navy vessels and everything else. I know you inspect the garbage that is on board

when it gets to port, but if 99 percent of it is thrown over the stern before it gets to port you are not really looking at an awful lot.

Dr. CAFFEY. In most cases, there is garbage aboard the vessels. What we are boarding for is to see that it is handled properly to preclude risk of plant or animal pest or disease introduction.

I understand that it is the policy in marine practices to dump the garbage overboard at sea. Now, our regulations do prohibit that dumping inside the territorial limits; however, this is something that would be very, very difficult to enforce.

Senator BREAUX. Does anybody have any idea? No one is required to report how many times a large vessel makes garbage dumps while they are cruising, do they?

Admiral KIME. No, they do not, Mr. Chairman. I think you have hit on a very good point.

One of the things that we are looking at right now for placing in these guidelines and also placing as a requirement in our regulation for vessels as a condition of port entry into the United States is that they maintain record books just as we have for oil and hazardous materials. The vessel must maintain a record book that must be signed by the master.

We believe that this is something the Norwegians have pioneered and submitted to us as a suggestion for inclusion in the guidelines, and we think that would go a long way towards doing that.

Senator BREAUX. That would not necessarily be a requirement of Annex V, but it would just be a regulation pursuant to Annex V?

Admiral KIME. Yes. Annex V cannot be amended until it comes into force, and we could say, well, maybe Annex V is not perfect; therefore, we do not want to ratify it. So we are trying to solve that with these guidelines.

We think that they bring together the best knowledge of the developed world and also then provide that information to the developing world. We think based on past experience that they will be very widely implemented. We believe that our bill would permit us to put those provisions into domestic regulation.

Also, in addition to the record book, we believe that there should be a requirement that a placard be posted as we have done with oil pollution. If you have a pleasure boat right now that has a motor, you are supposed to have a placard indicating it is illegal to discharge certain products, oil in this case, and what the penalties are. We would propose doing the same thing for garbage.

Senator BREAUX. I want to recognize now our distinguished Vice Chairman of NOPS, Senator Kerry, for any comments or questions he might have.

OPENING STATEMENT BY SENATOR KERRY

Senator KERRY. Thank you, Mr. Chairman. I apologize for not being able to be here for the full hearing. I am delighted this hearing is taking place.

On Friday, the Foreign Relations Committee, of which I am also a member, will be having hearings on the Annex V issue. I support Annex V. I think it is important.

I must say as a resident of Massachusetts who spends a lot of time trying to preserve the treasure of our seashore, I was recently

down in the Vineyard sound and islands area of Buzzards Bay and Nantucket, that area around the Cape. Never in the almost 40 years that I can remember going to that region, have I ever seen the amount of plastic netting, plastic bags, and plastic containers floating around. The debris on the beaches is beyond anything I can ever remember and beyond the capacity of individuals to go out and clean them on their own.

The stories I hear from fishermen and boaters, pleasure and commercial, of screws that are tangled and other problems that they have, ingestion into ports and so on, air intake, water intake, whatever, are just extraordinary.

I think it is something that is obviously difficult to enforce. It is obviously confusing, and I am not sure, as there are for many problems, easy solutions. Obviously if you are not working towards them in concert, there is no solution, whether it is easy or otherwise. Right now I have this strange feeling that we are partly being immersed in the problem because there has not been that kind of a concerted effort.

Now, I sense that there is even a divergence between the Coast Guard and the Department of Agriculture, et cetera, in what is or is not an incentive or how we are now enforcing. I will ask Dr. Caffey, is it not a fact that the regulations in the Department of Agriculture currently have the effect of almost encouraging the dumping by virtue of the sterilization and disposal requirements for ships when they come to port which are complicated so that they do not undertake to dispose of their trash and, therefore, they are encouraged to dump?

Is that fair? Have you heard that criticism?

Dr. CAFFEY. Yes, sir. We have heard those thoughts.

In effect, our regulations require that if the material is offloaded ashore, then it must be rendered harmless insofar as plant pests or animal disease risk is involved. Now, that does involve a cost. The physical offloading of the material from a vessel and taking it to an incinerator or cooker actually entails cost. However, offloading of anything from the vessel, whether we restrict it or not, would also entail cost.

Do you follow what I am indicating?

Now, the amount of what we consider to be garbage, we being Agriculture, is considerably different. Our definition of garbage is considerably different than what Annex V or what I understand Annex V says is garbage.

We are limiting our garbage definition to the food material and any of the wrapping or other kinds of material, that the food came in contact with. It does not include such things as these large plastic sheets for wrapping of cargo, the ropes, the netting and all that material unless it comes in contact with garbage.

So the amount that we are specifically concerned with is much less. Again, offloading of any material is going to cost money in the ports, whether it is restricted from our standpoint on the plant and animal disease side or just being offloaded and disposed of at a landfill or some other type of a reception facility.

Does that address your question?

Senator KERRY. It does. I realize there is a distinction between the two. I guess what I am saying is, though, that regardless of the

distinction between the different kinds of garbage, once you have a regulation which establishes a process for offloading at dock and the alternative is not offloading at dock, that is dumping at sea, you are encouraging the dumping at sea.

I guess I am asking you is there some way, has any way occurred to you or has anyone suggested any way which might disincentivize the dumping at sea and make it easier to offload at dock or reduce the cost or encourage that offloading through some other simpler process? I do not know what it is.

It might be to have available disposal sites as you come into harbor. Perhaps ports have to circulate offloading facilities ship to ship in the harbor. I do not know. I know that in some small little harbors in some regions of New England, the harbor master takes the effort of having a waste barge run around the harbor, and people are encouraged to dump their waste because the alternative is that they are going to just put it in the water. It works, and people know it, and they view it as an available clean method of disposal.

Why can we not do things like that?

Admiral KIME. Senator, I think you are exactly right, and I think that will happen.

Let me just add to what Dr. Caffey said.

First of all, his requirements only apply to certain foodstuffs and only then if they are purchased overseas other than in Canada. These foodstuffs even then can be separated out and can be disposed of up to 12 miles from our shores under the provisions because it is biodegradable, will generally sink, and even then if it is put through a comminuter to grind it up to one square inch size particles, it can be even discharged within up to three miles.

So I think if we educate the people aboard ship that the way of doing business is to separate—first of all, if it is not from a foreign source, it can all be mixed together and thrown in a Dempster dumpster when you get ashore. If it is from a foreign source, it can be separated and ground up and disposed of before you get ashore.

If you do none of those things, then and only then would you have to have a problem of meeting the Department of Agriculture regulations.

We in the Coast Guard do not see this as a considerable disincentive. I think there will always possibly be scofflaws just as there are with any laws that we pass. I think in general people are very conscientious about that. I think our highways are cleaner today than they were 20 years ago.

I believe the private industry looks at this as an economic opportunity. I have seen this in practice. I was Captain of the Port of Baltimore back in the late 1970s, early 1980s when we had all the coal ships backed up in the Chesapeake Bay off of Annapolis to load. We worked very closely with the governor's office and the Department of Agriculture in that case to make sure we did not get garbage thrown into the oceans. A launch service was generated literally overnight. Incinerators were approved. Exorbitant charges were not made on the shipowners. Probably if they had been, another incinerator would have developed.

So we are not pushing the state of technology on this. Really, all we are doing here is to do the same thing with ships that we have

been doing with airplanes for years, because every airport has either an incinerator or a means of putting these materials in leak-tight bags where they can either be taken to an incinerator or to be sterilized, as he said.

So it is not easy, but I certainly do not see any dichotomy between our requirements and those of the Department of Agriculture.

Senator KERRY. Well, I will accept the concept.

How are you planning to work together, assuming that we advise and consent as to Annex V, to implement it?

Admiral KIME. We have been working together, Senator, since about 1984, I believe, in a group. To address this particular issue, I think we would be looking to the Department of Agriculture to assist us in the educational program and also, where necessary, to be certain that they can approve any new incinerators or sterilizing units that might be necessary. I think that is the main thing that we would be concerned about.

If they did have any of their people aboard ship as they do from time to time, we would want them to coordinate with us, as they already do, to assist us in enforcement. I think from the Coast Guard's point of view, that is what we would be looking for from the Department of Agriculture.

Senator KERRY. Maybe I am having difficulty understanding or I am missing your explanation, but it seems to me there is an inherent coordination problem if Agriculture is concerned with one kind of garbage and you are going to have a division of labor as to who is responsible for X, Y and Z types of garbage, and then over here you have plastics and filaments and whatever, and somebody else is responsible for those.

Do we not have to have one entity responsible for anything that can be thrown over a ship?

Admiral KIME. Senator, theoretically you may have a point, but I think my practical experience, as I mentioned, is that in the Port of Baltimore that did not exist, and we had that same difference right there in the Chesapeake Bay. Under the Refuse Act of 1899 you cannot throw anything over the side; therefore, we had the Coast Guard enforcing that and Agriculture enforcing their provisions.

The Coast Guard is in the business of coordinating with other agencies, both Federal and local. That is the basic way we do business, whether it be port security, oil prevention, oil pollution response or, in this case, plastic pollution. So I think this is just going to require that we do coordinate.

I have not had this problem put forward to me as strongly as you have in the past. I certainly am going to go back and look at it as a result of that, but I do not think that is insurmountable. I think that can be worked out.

Dr. CAFFEY. I think we would agree. Consistent with our mission, on those vessels that we are involved with anyway—you mentioned the log or documents maintained by the vessels we could review those when we are on the vessels with very little problem.

Senator KERRY. What would that show you?

Dr. CAFFEY. As Admiral Kime has mentioned, this was one of the thoughts about the possibility of where plastics had been dumped,

maybe how much they have or what their actions on the vessel had been.

Senator KERRY. You are suggesting to me that if Annex V is in effect and there is a law against it, they are going to record and log their dumpings of illegal trash?

Admiral KIME. Senator, I would suggest that if it were a U.S. regulation and a condition of port entry as it is in the case of oil, that yes, they would, especially if we had the fines that are in our bill, which are $25,000 per day civil, $50,000 criminal, and five years imprisonment. This is a major incentive, I think, to do what they should be doing.

We are taking a page out of the same book that we have used for oil pollution prevention and also for hazardous chemicals, and that has been extremely effective. I think with oil, based on the latest IMO information, for the last year compared with 10 years ago, we have reduced the amount of oil going in the ocean by 500 million gallons, of which about a quarter of this or 125 million gallons would have gone in off the United States.

An oil record book plays a very key part in that, because while the accidents and collisions such as the *Arco Merchant* up off the coast of New England and the *Amoco Cadiz* draw the attention, most of the oil that got in the oceans came from operational means. I think that we can draw a parallel here with plastics.

Senator KERRY. Mr. Chairman, I do not want to take up too much time here, but is there a difference in the traceability of an oil dump versus plastics?

Admiral KIME. In some cases we do have mechanisms for fingerprinting oil and determining where it did come from if we can get the oil in time and if we can get a sample from the vessel. Unless the garbage that they discharge has the name of the vessel on it, then it would be more difficult to have direct traceability.

Senator KERRY. So, in point of fact, there is a stronger kind of self-incriminatory compulsion to record and be accurate as to that which you know you may be found out about versus that for which you can escape detection. Is there not?

Admiral KIME. Yes, sir, there certainly is.

Senator KERRY. My concern is simply that when the cook or somebody goes aft and hangs over the fantail and just dumps the stuff, the captain is looking the other way or the thing is on iron mike and nobody is looking to see who did it, and it is not going to get logged. I think with regard to dumping that there are other incentives.

Now, we had 64,000 ship landings, I guess it was, last year. Only 1,800 of them saw fit to try to unload garbage in port facilities of any kind.

Admiral KIME. Probably, Senator, because the law does not require it. The law does not prohibit it from being dumped in the oceans, and if we use the difficulty in enforcement as an argument, therefore, not to create a law just because it cannot be 100 percent effective immediately, then we will never have a law, we will never have——

Senator KERRY. I do not encourage that. I agree with you. You are absolutely correct. I am just worried about the incentives and capacities we create simultaneously for enforcement.

Let me ask you just very quickly about that. Do you feel that the Coast Guard has the current manpower and fiscal resources to enforce Annex V?

Admiral KIME. I think we do, Senator. I believe we are going to have to look obviously not towards putting a Coast Guard officer or petty officer on every boat, but we are going to have to look to means that are consistent and compliment our current port state control, our boardings, et cetera, that we do for oil, harzardous materials and the safety considerations to do this, and also look for cooperation from our friends at the Department of Agriculture and other agencies that do go aboard these vessels.

Obviously, I would say that given those caveats, yes, we do.

Senator KERRY. Well, I thank you, Admiral, very much, and I think you are absolutely right, incidentally. The sooner we change people's thinking about it and create a new standard of behavior, certainly we will make some gains. I stand ready, as I am sure others do, to try to help you have those resources to be able to get out there and do it.

Thank you.

Thank you, Mr. Chairman.

Senator BREAUX. I thank the Senator for his questions.

Only in the United States would we have a big difference over what constitutes garbage in the bureaucracy of our country, and it suggests that perhaps we need a Secretary of Garbage to work this detail out.

Senator KERRY. I would never think of increasing our current bureaucracy. I think we have a number of people who could handle that job right now.

Senator BREAUX. Mr. Koss, it seems like the Coast Guard is saying on their vessels they are able to take care of this problem, and merchant vessels are able to take care of this problem to a greater degree; but it seems that on behalf of our own Navy, you are saying that were Annex V to be in place that the Navy would not be able to comply.

Mr. Koss. We would be able to comply with all portions of Annex V except for the plastics problem. We cannot comply with that today, although we intend to in the future. We cannot comply today because our ships are significantly different. We have large crews, high population density, and we have no room aboard our ships. It is an absolute requirement that all waste be removed from the ship as soon as possible because of concern about fire and sanitation problems. With that many people in such a small space, we just cannot risk any type of hazard.

However, we are very aware of the need to go beyond Annex V. In effect, we have been working for years to develop equipment that will not cause waste at sea to sink, which would go well beyond Annex V, and we are very close to it. We are developing a pulper and a compactor in our laboratory in Annapolis, and we think in a few years we will have something no one else has.

At the same time, we intend to initiate a research project next year to develop the means to handle the plastic waste aboard ship. It does us no good to segregate it if we cannot store it, and we cannot store it because of the fire, safety and health hazards. How-

ever, once we develop this special device to put aboard our ships, we will be able to comply in the long range with Annex V, sir.

Senator BREAUX. Does Annex V eliminate coverage on Navy vessels?

Admiral KIME. It eliminates public vessels, yes, it does, Mr. Chairman. Let me just say that our legislation, though, does require that public vessels, of which Navy and Coast Guard vessels fit into that category, to comply as far as reasonable and practical due to operational constraints.

That is the same language that we have in the APPS right now for Annex I on oil pollution, and I can say that we worked very closely with the Navy and they are in compliance with Annex I now. They have brought their ships into compliance even though they are not required to do so, as has the Coast Guard. I would say that I foresee that happening again.

Also, to say something possibly, in addition, on behalf of our younger but larger seagoing sister service, the Coast Guard should not be used as a club to beat them about the head and shoulders, because our ships do in proportion to their size carry smaller numbers of crew and do stay out a shorter period of time. So in many respects, our problem is a bit smaller than theirs.

Senator BREAUX. Does the Navy do anything to reduce the use of plastic products on board?

Mr. KOSS. We have just begun to look into that, sir. We have only begun. It is a long-term issue.

Senator BREAUX. Right now, what do you do with plastics?

Mr. KOSS. In terms of controlling what comes on?

Senator BREAUX. No. Where do they go?

Mr. KOSS. Plastics are entrained with all other solid waste which is discharged overboard at sea beyond 25 miles.

Senator BREAUX. Are there any numbers or any other comparison as to how much waste we think we are getting from our Navy vessels compared to our merchant vessels? You have vessels with 3,000 or 4,000 men aboard.

Mr. KOSS. We have some general rules of thumb that we work with, but basically we generate three pounds per man per day of waste. Two pounds of that is solid waste, one pound is wet garbage. Less than one-tenth of a pound per man per day is plastic, and that would ultimately be captured and controlled in the long term.

Senator BREAUX. What is your outlook on the best means of controlling plastic disposal from a Navy standpoint?

Mr. KOSS. We intend to develop a thermal compaction device, which we really feel will work. We have great confidence that using high temperatures and pressures, we can feed plastic into it and we can compact the plastic down to, say, the size of a brick, and we could store that safely and easily and bring it back to shore. We need a few years to be able to do that, sir.

Senator BREAUX. So storage and bringing it back to shore as opposed to incinerating at sea is a better methodology from the Navy standpoint?

Mr. KOSS. Incineration is a whole different ballgame. We have experienced very poor results with incinerators. We have been testing and evaluating incinerators aboard ship for years, and there are just too many safety problems, maintenance problems, weight

and space problems. There are just so many practical problems with incineration aboard ship.

One of the biggest things with plastics is you have to develop something specifically for plastics. Plastic has a very high energy content. You have enormous temperatures. With the device we are looking at, we only have to heat it several hundred degrees as opposed to several thousand degrees. It would just be much safer and much smaller, more sensible for use aboard ship.

Senator BREAUX. Dr. Davies, you had talked in terms of consideration of alternate products other than plastics or biodegradable plastics. Where are we with regard to that?

Dr. DAVIES. What we are doing is setting up a task force to investigate the statutes that we have available to us. Perhaps we would look at the manufacturing process rather than the waste process.

We have not investigated that to any extent at this point in time.

Senator BREAUX. Is that something that industry should be doing or is doing as far as you know, as far as looking at alternatives to nonbiodegradable plastics?

Dr. DAVIES. Yes, I think so.

Senator BREAUX. The EPA is not going to be involved in that?

Dr. DAVIES. I think the EPA will be somewhat involved in it, but I am somewhat concerned about some of the issues that we have talked about today, particularly the fishing gear, which would have to be made in plastics that are persistent plastics. I am not sure we would get around that problem with biodegradable plastics unless it was in terms of degrading over a number of years.

I think with containers and things like the six pack holders, I think we should be moving toward using biodegradable plastics for those.

Senator BREAUX. Well, we thank all of you for your presentation. It is obviously a very serious problem of very large proportions.

Admiral, I understand from staff now that legislation has not been referred to any of our committees as of yet. It is still being held at the desk, but I think we plan to move very promptly on it. At least with that in place, I think it will be a major step in the right direction.

We thank all of you for being on our panel.

Admiral KIME. Thank you, Senator, and I will say the same thing to you that I said to Chairman Gerry Studds of Massachusetts in the House, that we are prepared to lock our staff in a room with your staff and not give them any food until they come out with a bill that everyone can live with.

Senator BREAUX. If they get any food, do not use plastic containers, right?

I would like to welcome our second panel, which will consist of Dr. Michael Liffmann from Louisiana Sea Grant College Program; Mr. Garry Mauro, Commissioner of the General Land Office of the State of Texas; Mr. Roger McManus, President of the Center for Environmental Education; and Ms. Sally Ann Lentz, who is staff attorney for the Oceanic Society.

STATEMENTS OF DR. MICHAEL LIFFMANN, ASSISTANT DIRECTOR, LOUISIANA SEA GRANT COLLEGE PROGRAM, CENTER FOR WETLAND RESOURCES, LOUISIANA STATE UNIVERSITY; GARRY MAURO, COMMISSIONER, TEXAS STATE GENERAL LAND OFFICE; ROGER McMANUS, PRESIDENT, CENTER FOR ENVIRONMENTAL EDUCATION; AND SALLY ANN LENTZ, COUNSEL, OCEANIC SOCIETY

Dr. LIFFMANN. Thank you, Mr. Chairman. I am Michael M. Liffmann, Assistant Director of the Louisiana Sea Grant College Program, a component of Louisiana State University Center for Wetland Resources.

Marine litter, including plastic debris, is a historical and all-too-common presence along the shores and in the marshes of coastal Louisiana. The problem has multiple sources but can be traced to several prime contributors: the offshore oil and gas industry; commercial and sport fishermen; the maritime shipping community; and our urban waste management practices.

The problem has become even more apparent over the years with the increased use of plastics. Little documentation exists regarding plastic pollution in the Gulf of Mexico outside of Texas. It is known, however, that plastic bags and other items are a threat to sea turtles, seabirds, marine mammals, fin fish and shellfish.

Human safety and productivity also suffer from the problem as commercial and sport divers become entangled in abandoned gear and gulf fishermen and boaters spend thousands of dollars to repair damages to their vessels when intakes are clogged and propellers are entangled in plastic items.

Experts also agree that the development of Louisiana's coastal recreation and tourism potential has been impaired by the overall litter problem. Unaesthetic conditions definitely reduce recreational enjoyment of beach resources and discourage tourists from visiting our coast.

The Louisiana Geological Survey is now conducting a year long study concerning the types and origins of litter found on six Louisiana beaches. The first quarterly survey indicated that nearly 60 percent of the major items found on these beaches were plastic and styrofoam.

Two beach cleanup projects conducted at Grand Isle in 1985 and 1986 had similar findings. A major coastwide cleanup which is scheduled for September 19 of this year, designed to spruce up some 18 beaches and attract about 4,000 to 5,000 persons, is anticipated to have similar results.

We have had numerous, well-coordinated public and private initiatives in our efforts to address the problems. Participating public agencies include the U.S. Minerals Management Service, a component of the U.S. Department of the Interior; our own Louisiana Sea Grant Program; and several state departments, namely Natural Resources, Culture Recreation and Tourism, Wildlife and Fisheries, and Environmental Quality.

Private support has been very notable as well. It has been provided by groups such as the Offshore Operators Committee, a group of 60 offshore companies; the Louisiana Nature and Science Center in New Orleans; the Clean Team; the Gulf Coast Conservation As-

sociation; and the Concerned Shrimpers of Louisiana. Several coastal communities should be singled out as well, particularly communities in Lafourche and Cameron Parishes, as has the town of Grand Isle.

It is clear that the answer to the problem will result from a cooperative effort among Federal, State and local governments and the private sector, Mr. Chairman. Solving the problem is largely a matter of education and policy. Several educational demonstration projects are recommended in my written testimony, as is ratification of Annex V of the MARPOL treaty.

Strong consideration should also be given to designating the Gulf of Mexico as a special area.

Mr. Chairman, in coastal Louisiana we have had a notorious tradition of disposing of litter and debris in our waterways, marshes and the Gulf of Mexico. The problem has been exacerbated by the waste disposal practices of the offshore oil and gas industry, commercial and recreational fishermen, the maritime shipping community, and our urban areas.

No one is to be singled out for blame. We are all to be blamed, as we have taken our environmental bounty for granted and have, in fact, neglected it. As I have testified earlier, there is reason for optimism. Concerned citizens from all walks of life and public agencies are diligently working together in an attempt to shed the lackadaisical attitude toward our environment in general and our unique coast specifically.

This concludes my oral testimony. I would be prepared to answer any questions you may have.

[The statement follows:]

STATEMENT OF MICHAEL M. LIFFMANN, ASSISTANT DIRECTOR, LOUISIANA SEA GRANT COLLEGE PROGRAM, CENTER FOR WETLAND RESOURCES, LOUISIANA STATE UNIVERSITY

Mr. Chairman and Members. I am Michael M. Liffmann, Assistant Director of the Louisiana Sea Grant College Program, a component of Louisiana State University's Center for Wetland Resources. I would like to thank the National Ocean Policy Study and Senate Commerce, Science and Transportation Committee for providing me with this opportunity to discuss issues concerning plastic debris pollution in coastal Louisiana.

My presentation will focus on the most likely sources of the plastic debris found in the Gulf of Mexico in general and Louisiana in particular; its nature, probable effects and estimated magnitude. I would also like to identify the work being carried out by federal, state and private interests in the state in order to mitigate the problems. The testimony will conclude with some ideas regarding near-term actions that should be taken to combat the overall problem.

But before I begin, I would like to point out that our colleagues in the National Sea Grant Program and its 30 member institutions throughout the country are intensely involved in a wide array of activities relating to marine debris issues. Sea Grant's marine advisory agents and communicators are devoting considerable time and effort to battling the problem at a local and regional level. Research opportunities are also being explored, and a National Steering Committee composed of 10 Sea Grant directors, advisory agents and communicators has been established to provide liaison within the network. The Sea Grant Association 1987-88 will be providing written testimony to this Committee concerning the Sea Grant family's accomplishments to date, planned future activities, and general recommendations.

LOUISIANA'S MARINE DEBRIS PROBLEM

Coastal Louisiana was created by the Mississippi River, which over thousands of years deposited sediments and formed a series of overlapping deltas. The river periodically altered its course and today's coastal region is composed of distinct delta lobes that are rich in natural and cultural resources.

Louisiana's coastal region is unique, containing numerous lakes, bays, inlets, marshes, narrow sandy beaches, and ridges called "cheniers" that rise from flat, coastal marshes. The coast is heavily crisscrossed by bayous and man-made canals and is partially protected by slender barrier islands. While the official shoreline is only 216 miles long, the crenulations add 15,000 miles to the total length of the coastline.

Marshes and estuaries nurture an abundance of fish and wildlife. Louisiana is among the leading producers of finfish, shellfish, and furbearers. Oil and gas exploration takes place throughout the region as well as in offshore waters. Recreational opportunities for visitors in south Louisiana are varied and numerous. There are New Orleans and its special historical identity; sport fishing in inshore and offshore waters; waterfowl hunting and birding; and natural beaches that allow many other outdoor activities. Despite the amenities and attractions, Louisiana's coastal region is a simple place where recreation and work overlap. The demands of coastal industries, the area's unstable marshes, and the perennial threat of hurricanes have combined to limit resort development. There are relatively few accessible, sandy beaches and those that exist are often narrow and brown with silt.

Despite its simplicity, Louisiana's coast offers a breathtaking natural beauty, with ample fish and wildlife and a subtropical climate that enables year-round outdoor recreation. But along with this natural beauty and abundant wildlife is another widespread, yet undesirable characteristic: man-made debris. Beer cans, bottles, plastic products in every shape and form, tires, oil drums, monofilament lines, derelict fishing gear, nets and crab traps, and styrofoam items are just a few of the kinds of litter found everywhere. It is unsightly and fosters a negative impression of the state. Louisiana has too frequently been called "Louisiana, the litter state".

But as this Committee well knows, the problem is not confined to Louisiana and the Gulf of Mexico. Coastal areas from Alaska to Maine are plagued with this form of pollution and alarm is spreading among coastal community leaders, interested citizens, and environmental groups. Marine litter, defined as any man-made object of plastic, metal, wood, glass, cloth, or paper present in the marine environment, is not just an aesthetic problem. It poses serious dangers to both people and marine life.

SOURCES AND EFFECTS OF THE MARINE LITTER PROBLEM

As I pointed out earlier, marine litter is a historical and all-too-common presence along the shores and in the marshes of Louisiana. The problem has multiple sources but can be traced to several prime contributors. These include the offshore industry, namely oil and gas exploration and production, which until very recently had steadily grown in size; extensive commercial and sport fishing activities; and a very active maritime shipping industry. Other sources include land-based recreational activities such as beach-going, surf fishing, and waterfowl hunting, and the nonbiodegradable litter carried by our rivers, bayous, and streams from urban areas.

It is unfortunate that no Louisiana-specific statistics are available at this time, although several quantitative surveys are underway. On a broader scale, the National Academy of Sciences estimates that each year the world's merchant marine fleet discharges some six million tons of debris into the sea. Thousands of ships and other seagoing vessels annually call at our Gulf coast ports and there is evidence that much of the waste that they discharge washes up on our shoreline.

The Academy also estimates that nearly 300 million pounds of fishing gear are annually lost or discarded by the world's fishing industry and that some 50 million pounds of plastic materials are dumped into the water. Sea Grant marine agents and commercial fishermen in Louisiana agree that gear is frequently lost and that many plastic items are discarded into the Gulf of Mexico. They have pledged to work toward a solution.

Recreational boaters and visitors to our beaches also contribute generously to the overall problem: plastic bottles, beer and soft drink cans, cups, bags, utensils, and six-pack yokes are frequently thrown overboard or left on the beaches. Educational programs are being presented to these groups through sportsmen's clubs, fishing tournaments, and other conservation-oriented organizations in the hope of improving public awareness of the problem and affecting a change in attitude toward discarding such materials.

Even when litter is disposed of properly, it often reaches the Gulf anyway through antiquated municipal drainage systems and poor solid waste management facilities and practices.

Floating debris associated with the offshore oil and gas industry has been recognized for the past several years as a serious and growing problem. It is also the only

major industry in the Gulf of Mexico that has begun a concerted effort to resolve its share of the problem. The Minerals Management Service (MMS) estimates that there are approximately 4,500 active outer continental shelf (OCS) leases in the Gulf, most of which lie off the state of Louisiana. Some 3,100 offshore platforms in state and federal waters off Louisiana are staffed by nearly 30,000 persons and served by a fleet of approximately 800 work vessels. A report filed by this agency in 1985 indicates that ". . . a preponderance of the floating trash coming ashore in the Western Planning Area and a significant portion of the Central Planning Area (of the Gulf of Mexico) is associated with the offshore oil and gas industry."

The problem has become more apparent over the years with the increased use of plastics. The very qualities that have made them desirable, durability and longevity, make them a hazard in our marine environment. It is estimated that nearly half of the man-made debris sighted at sea is plastic. But that is only the visible part. Some sinks, but the great majority washes up on shores around the world. Little documentation exists regarding plastics pollution in the Gulf of Mexico, outside of Texas. It is known, however, that plastic bags and other items are a real threat to sea turtles, and that many seabirds, marine mammals, finfish and shellfish die every year from entanglement in derelict fishing lines and nets or from the ingestion of plastic debris as food.

Human safety and productivity also suffer from this problem. Commercial and sport divers become entangled in abandoned fishing gear, and Gulf fishermen and boaters spend thousands of dollars to repair damages to their vessels engines when plastic products clog the water intakes and derelict fish nets or ropes entangle propellers and drive shafts. Although no human deaths or life-threatening injuries from beach debris have been documented, serious concerns have been expressed about the 55-gallon drums that frequently wash ashore on Louisiana and Texas shores.

The development of coastal recreation and tourism is also impaired by the marine litter problem. Unaesthetic conditions definitely reduce recreational enjoyment of beach resources and discourage tourism from visiting the coast. It is well known that adverse events such as shark sightings, jelly fish, oil spills, foul weather, litter, and unsightly conditions adversely affect visitation. The National Park Service has reported substantial maintenance costs associated with keeping Gulf coast beaches free of such debris.

Louisiana officials have frequently stated a desire to promote the state's coast for tourism and recreation purposes. If they are to succeed, it is vital that all possible precautions be taken to insure that the visitor had a favorable experience. If visitors criticize Louisiana's beaches and marshes as being filthy, other visitors are likely to stay away. Tourism is Louisiana's third largest industry and travel expenditures in the state reached $3.8 billion in 1985. The state's leaders have recognized the uniqueness and importance of our coastal resources for the generation of tourism activities, and have indicated a strong desire to increase the relative significance of this industry in the state's economy. The debris problem must be dealt with if the state is to generate additional revenues from coastal attractions. It certainly has not been a priority item to date.

MAGNITUDE OF THE MARINE LITTER PROBLEM

Regrettably, little information has been gathered to quantify the magnitude of Louisiana's problem. In a year-long study, however, the Louisiana Geological Survey, under contract from the Department of Natural Resources' Coastal Management Division, is now investigating the types and origin of litter found on six Louisiana beaches located on the mainland and on barrier islands.

The first quarterly survey was completed in May of 1987. Initial findings indicated that plastics and stryrofoam accounted for 59% of the major items found on the beaches. Some of the most frequently counted items were six-pack yokes, milk and water jugs, plastic bags and bottles, polypropylene rope, and soft drink containers. Other items found included hard hats, pipe-thread protectors, rubber gloves, strapping bands, and plastic sheeting.

Two beach clean-up projects conducted in 1985 and 1986 at Grand Isle yielded some information. About 80% of the 20 truckloads of garbage picked up along a six-mile section of beach consisted of plastic and styrofoam materials. Most evident were milk and water jugs and bottles that had contained household items such as detergent, shampoo, deodorant, soft drinks, and bleach.

Considerably more information will be available after the Louisiana Coastal Cleanup is completed on September 19, 1987. Eighteen beaches along the entire coast will be swept by some 4000-5000 volunteers.

Anecdotal evidence of the problem is ample. Recently, some visiting French Canadians were asked their opinion of coastal Louisiana. They replied that it was a beautiful state . . . by night, but that it was very trashy during the day! In an article entitled "Plastic Pollution Is A Sad Fact of Life," Bob Marshall, outdoors editor of the daily *New Orleans Times Picayune* wrote, "Reggio Canal . . . State Road 626 . . . the Lake Pontchartrain Linear Parkway. I would like to nominate those three spots as state historic monuments. Ideally, the state would move tomorrow, while the tide is still low, to preserve these three landmarks, just as they are for future generations . . . And what would they see? Garbage. Of course they would glimpse some marsh along the canal, spot part of a nice hardwood swamp adjacent to 626 and, facing the parkway, the yawning mouth of Lake Pontchartrain. But mostly there would be garbage—plastic garbage. Miles of it. Tons of it . . . Louisiana, it seems, is on the leading edge of what is becoming a world problem: plastic pollution in the marine environment."

WHAT IS BEING DONE IN LOUISIANA TO COMBAT THE PROBLEM?

The single most active participant to date has been the United States Department of the Interior's Minerals Management Service in New Orleans. That agency, through its Environmental Assessment Section (ESA), identified trash and debris from OCS operations as a major problem to shorefront recreational beaches in Texas and Louisiana in 1977. In 1985, the agency solicited information on beach trash accumulations from managers and administrators responsible for federal and state parks in the Gulf of Mexico region. Their particular interest was in identifying the relationship of this trash to the oil and gas industry. The results were documented in the "Trash and Debris Scoping Report," which discussed perceptions of the scope, nature, and cost of beach litter as it related to the oil and gas industry and offered alternatives for mitigating the industry's contributions with special emphasis on voluntary measures.

The ESA has been enthusiastic in its cooperation with other public agencies and the private sector. Among its most recent credits are the organization of the meeting in Cameron, Louisiana, that gave rise to the Louisiana Coastal Cleanup '87 campaign and the agency's adoption of the beach at Fourchon, Louisiana, for periodic cleanup efforts.

Our Louisiana Sea Grant Program has also become very active. Through its Marine Advisory Services project for recreation and tourism development, the Communications Office and the marine agents' network, a major initiative is underway. An example of this commitment is the 1987 advisory report for Cameron Parish, prepared by the Louisiana Coastal Recreation and Tourism Assessment Team, an ad hoc multiagency effort coordinated by Louisiana Sea Grant. Among the numerous recommendations made to the parish (county) authorities interested in developing the recreation and tourism opportunities was one that succinctly stated that in order to successfully promote their magnificent natural attractions for tourism, they would have to deal with the litter problem along the 36 miles of accessible beaches. Cameron has wholeheartedly adopted this recommendation and is diligently working on several fronts to organize beach cleanup and maintenance operations.

Louisiana Sea Grant's Communications Office has launched a major public awareness campaign as part of the multiagency effort to clean up the coast. Through the use of advisory publications such as our newsletter "Aquanotes," television public service announcements, radio interviews, newspaper feature columns, and handouts, we are informing thousands of our residents how to keep our coast clean. Sea Grant has also been intimately involved in the planning and coordination of the Louisiana Coastal Cleanup '87 effort scheduled for September 19. Sea Grant's marine agents are working closely with commercial fishermen and 4-H youth in heightening their awareness of the marine litter problem.

Several state agencies are keenly interested in the situation and are active participants in the overall effort. These include the aforementioned Department of Natural Resources through its Coastal management Division and the "Take Pride in America" campaign; the Louisiana Geological Survey; the Department of Culture, Recreation and Tourism through its offices of State Parks and Tourism and the Litter Control and Recycling Commission; the Louisiana Department of Wildlife and Fisheries, and the Department of Environmental Quality.

The private sector has given all these initiatives an overwhelmingly favorable response. The Offshore Operators Committee (OOC) is an organization of 60 companies involved in oil and gas exploration in the Gulf. One of its primary goals is to educate employees about the importance of protecting the marine environment. In 1985, the OOC prepared an educational videotape focusing on three fictional off-

shore workers who deliberately or accidentally contribute to the litter problem. Later they become aware of this carelessness when they visit their favorite beaches and are disturbed by finding litter remarkably similar to that discarded days earlier. The OOC has also prepared hardhat decals designed to stress responsibility for keeping the waters free of litter.

Private groups such as the Louisiana Nature and Science Center and the Clean Team have been instrumental in conducting beach cleanup campaigns designed to create a public awareness of the severity of the litter problem. In 1985 an 1986, they mobilized several hundred volunteers to join Grant Isle's residents in a "Sweep of the Beach." These two organizations have joined forces once again and are organizing the 1987 coastwide campaign which is being heavily publicized as the "September Sweep of the Beach." The theme of the campaign is "Lend a Hand in the Sand," and support for the effort is being received from many other private organizations, in addition to the public entities cited earlier. Some of the more prominent private groups include the Gulf Coast Conservation Association (GCCA), the Concerned Shrimpers of Louisiana, the OOC and its member companies, Reynolds aluminum, and environmental groups such as the Louisiana Wildlife Federation, Sierra Club, and the Audubon Society.

Credit must also be given to several coastal communities for their interest and support in efforts to combat the marine litter problem. The town of Grand Isle has responded to cleanup campaigns by hosting large community celebrations and providing numerous facilites and services. Area motels have offered discounts to volunteers. Cameron Paarish is also moving in a very positive direction. Local citizenry are volunteering for a variety of roles during September's cleanup and at last count some eight beaches in that parish will be swept by volunteers. A similar approach is being pursued in Lafourche Parish where several beaches will receive attention.

WHAT ELSE CAN BE DONE?

Most scientists and resource managers who have been dealing with the situation for a number of years are of the opinion that solving the problem is largely a matter of education and policy. We concur with this assessemnt and add that in order to deal with the problem successfully, a cooperative effort among federal, state, and local governments and the private sector must be made. The Marine Debris Roundtable, which convened December 1986, concluded that education is essential to advise industry and the public of the need to properly handle and dispose of plastics and other kinds of persistent debris. Marine pollution is fundamentally a problem of public attitudes. It can be reduced by increasing public awareness of the effects of dumping trash into the ocean or on the coast. Awareness of the serious nature of the problem encourages mitigation efforts.

Special education and training programs should be directed at the various segments of the marine community. Programs such as those prepared by the Offshore Operators Committee and more recently the Center for Environmental Education should be encouraged and supported financially if necessary. Similar programs aimed at the shipping and recreation communities should be designed and implemented.

Recycling should receive a lot more attention than in has in our state. Technological solutions are also possible. Some heartier plastics have been replaced by biodegradable and photodegradable plastics that are rendered less ecologically harmful in a shorter time. Research is continuing on the feasibility of using degradable plastics or even other kinds of materials in fishing gear. While such research and development initiatives are frequently in the purview of the private sector, university research into these matters should be encouraged through federal funding support.

Demonstration projects such as the Marine Refuse Disposal Project sponsored by the National Marine Fisheries Service at the Port of Newport should be encouraged and expanded nationwide. The project entitled "Development of a Port-based System for Receipt and Disposal of Vessel-generated Nonbiodegradable Refuse," has as its main objective to encourage the marine community (in this particular case, commercial fishermen) to bring nondegradeable waste back to port. Several of Louisians's smaller ports would be excellent locations for such expanded demonstrations.

It is very evident that there is widespread support for the United States Senate to ratify Annex V of the MARPOL treaty and that it would achieve positive results. The annex would not only prohibit the discharge of plastics into the world's oceans but would also regulate disposal of nonplastic forms of garbage generated during a ship's normal operations beyond territorial seas and up to 25 nautical miles from land. Undoubtedly, ratification and eventual implementation would demonstrate to the rest of the world the U.S.'s resolve to protect the marine environment.

The Texas General Land Office has contracted with the Center for Environmental Education to conduct a study designed to document the need for a "special area" designation for the Gulf of Mexico. Special areas are shallow, closed basins where there is evidence of severe marine debris. To date, the Mediterranean, Red, Black and Baltic seas and the Persian and Oman gulfs have received such designation. This designation would ban the discharge of all garbage, with the exception of food wastes, beyond 12 mines from land. The designation would be obtained by amending Annex V. Rear Admiral J. William Lime of the U.S. Coast Guard, head of the U.S. delegation, has indicated that the U.S. plans to submit such an amendment in the very near future.

The thrust of the Land Office study is the environmental situation and the desirability of the special area designation for the Gulf. The Land Office also plans to investigate the economic implications of such a measure.

Mr. Chairman, in coastal Louisiana we have had a notorious tradition of disposing of litter and debris in our waterways, marshes and the Gulf of Mexico. The problem has been exacerbated by the waste disposal practices of the offshore oil and gas industry, commercial and recreational fishermen and the maritime shipping community. No one is to be singled out for blame. We are all to be blamed, as we have taken our enviromental bounty for granted and have in fact neglected it. But as I have testified today, there is reason for optimism. Concerned citizens of all walks of life and public agencies are working together diligently in an attempt to shed the lackadaisical attitude toward our environment in general and our unique coast more specifically.

This concludes my testimony. I am prepared to answer any questions you may have.

Senator BREAUX. Thank you very much, Dr. Liffmann.

Mr. Mauro?

Mr. MAURO. Mr. Chairman, I am Garry Mauro, Texas Land Commissioner. I want to thank you for allowing me to testify on the problem of marine debris. I would ask that the full text of my written statement with attachments be included in the record. I will summarize the key points and be happy to answer any questions at the appropriate time.

Twenty years ago President Lyndon Johnson used blunt language to advocate passage of the Clean Water Act. He said, and I quote, "There is no excuse for a river flowing red with blood from slaughterhouses, and there is no excuse, and we should call a spade a spade, for chemical companies and oil refineries using our major rivers as a pipeline for toxic waste."

Mr. Chairman, if he were alive today I believe he would be just as angry about a practice that threatens our American shores. Routinely and institutionally, ships under every nation's flag dispose of their garbage by throwing it overboard. Tons of debris are left to sink or float. The shipping nations of the world are using our oceans and our beaches as a garbage dump, and I think there is no excuse for that.

When I tell people about this practice, they usually respond, well, you mean that isn't against the law? Well, no, amazing as it seems, it is not. A 4,000 year maritime tradition of dumping ship garbage at sea posed little problem until World War II, but the advent of modern plastic just makes the practice totally unacceptable.

Simple garbage, of course, unused food, decomposes in the ocean if the fish and seagulls do not get to it first, but solid wastes do not biodegrade. Plastics, glass and styrofoam have become a major environmental hazard. Birds and marine life mistake it for food. In one noted instance, an infant pygmy whale washed ashore in Galveston and died of severe stomach infection. In its stomach, if you

can imagine, were a plastic bread wrapper, a Frito bag and a 30 gallon plastic garbage can liner.

Barrier islands provide Texas with some of the prettiest white sand beaches on earth. We have open beaches laws that guarantee public access to 293 miles of Texas beaches. The barrier islands and marshlands along with those in your home state of Louisiana, Mr. Chairman, are an extraordinary gathering point for migratory birds. Five national wildlife preserves are strung the length of our 377 mile coast, including the sanctuary that saved the whooping crane from extinction.

We have spent millions of dollars and thousands of hours in the fight to protect wildlife and insure the public's right to enjoy our beaches; yet we have allowed those same wetlands and beaches to become the garbage dump of the world's fleet.

As Texas Land Commissioner, I am elected to manage the public domain, which includes our beaches and submerged lands in the Gulf. My exposure to this problem began in 1986 when I participated in a beach cleanup sponsored by the Center for Environmental Education. On a single day last September volunteers picked up 124 tons of garbage off 122 miles of Texas beaches. This spring, volunteers picked up 140 more tons in just a few hours.

At the General Land Office we have sponsored a "Don't Mess with Texas Beaches" anti-litter campaign. We have a Texas "Adopt a Beach" program. It is the first statewide program of its kind in the Nation. Corporations and civic organizations maintain a regular schedule of beach cleanups.

From seismic vessels and oil and gas platforms in Texas waters, the Texas General Land Office now requires detailed solid waste management plans. We allow these operators flexibility in the specifics of their plans, but they must abide by their proposals, and if they get caught dumping solid waste in our waters they forfeit their permits and their leases.

These efforts only address 20 to 40 percent of the trash on Texas beaches. We analyzed the debris in that first coastwide cleanup, and I would like to show you what we mostly found. This is a bottle of Bitter Lemon Crush from Great Britain. This is shampoo from Denmark and Venezuela. Toothpaste from Italy. Dishwashing detergent from Singapore. Mr. Chairman, Texans did not leave these on our Texas beaches.

The world shipping fleet discards at least 5.5 million metal, glass and plastic containers at sea each day. Also, the U.S. Department of Agriculture, fearing entry of foreign bugs and microbes, prohibits foreign ships from disposing of garbage in our ports unless it is burned or steam sterilized; but few ships are equipped for that, and fewer American ports have approved facilities for waste disposal.

Of 73,614 foreign ship landings in the U.S. last year, only 1,731 offloaded any garbage. In Texas, over 20,000 ships docked in Texas ports, and a grand total of 90 offloaded any garbage. Virtually all shipping garbage gets dumped at sea.

Now, we in Texas have a special problem. As you can see from that map over there, the currents that help construct our white sand beaches also channel the Gulf's floating debris toward the Texas coast, and our problem can only get worse. Home ports in Galveston and Corpus Christi will be a great boon to the Texas

economy, but they will also greatly multiply the number of U.S. Navy vessels in the Gulf. Navy ships routinely dump their trash at sea. As previously testified, they generate three pounds of solid waste per man per day, and some of their crews number well over 5,000.

Mr. Chairman, as you know, the Senate is now considering ratification of Annex V of the MARPOL treaty which would prohibit dumping of all plastics in the ocean. Also, other solid waste could not be dumped within 25 miles of any shore, and ports would be required to provide reception facilities. Texans would hope that you all act quickly to ratify Annex V.

In addition, Annex V designates special areas where no solid waste dumping is allowed. Currently designated special areas such as the Mediterranean Sea and the Persian Gulf are all shallow closed basins with heavy shipping traffic.

This winter, the U.S. delegation to the International Maritime Organization will seek to designate the Gulf of Mexico, which shares those same characteristics, as a special area. That proposal has the unanimous support of the Coastal States Organization, which represents all 35 U.S. coastal states, commonwealths and territories. It also has the support of the Western States Land Commissioners Association, representing my colleagues from 23 states; and, in addition, the National Wildlife Federation. We hope the Senate will support that effort as well.

To be effective Annex V must have teeth. We must enforce United States Department of Agriculture regulations without encouraging and institutionalizing the dumping of ship garbage; but to achieve results, we need to avoid imposing an undue regulatory burden on the shipping industry. The industry advocates onboard incineration. Congress could provide incentives to install the necessary equipment.

Port facilities must also be made capable of receiving and properly disposing of all floating garbage. The USDA supervises garbage disposal from international flights at all international airports every single day. Ordinarily, they do that through contracts with private waste management companies. Why can't a similar private sector cost efficient program deal with ship garbage at our ports also?

Regulations that insure compliance with Annex V must recognize three things and only three things can happen to ship garbage: If it is not burned or offloaded, it is dumped in the sea. Ships calling at U.S. ports should be required to present garbage for offloading or else show evidence that their solid waste was properly disposed of somewhere in the world. If they cannot do that, they should be denied port entry or fined heavily.

The answer need not create more problems than it solves. In the same way that we in Texas deal with our offshore oil and gas operators with flexibility of planning, spokesmen for the U.S. shipping industry have responded favorably to the idea of an individually tailored solid waste management plan for each ship company and ship.

They suggest that the captain's log is the obvious tool of enforcement. Each ship's captain should be required to make a daily entry stating the time and place of its garbage disposal and certifying,

swearing to, that the disposal complied with Annex V and United States law. If a ship captain falsifies the log, he can lose his license. Make captains record how they manage their solid waste in accordance with Annex V and make them present their logs at U.S. ports before entry.

Pollution of American beaches by international shipping is a crying shame, and it ought to be a crime. I am glad to say that I have spoken to few people who disagree. U.S. shipping interests have acknowledged their role in the problem and say they want to be part of the solution. The Navy has pledged to do its part. So have the fishing, shrimping and oil and gas industries. Nobody wants to go to a beach and wade through garbage, and nobody wants to be blamed for the filth that desecrates our shores.

This problem is not confined to Texas or the Gulf of Mexico. It endangers wildlife, threatens tourist industries, and fouls American beaches from Rhode Island to Louisiana to Oregon to Alaska. We must change behavioral patterns that have been accepted for centuries, and that demands national and international action.

Mr. Chairman, we need your help. We ask for the ratification of Annex V and passage of effective enforcement legislation, and we ask that it be made an urgent priority.

Thank you.

[The statement follows:]

STATEMENT OF GARRY MAURO, COMMISSIONER, GENERAL LAND OFFICE STATE OF TEXAS

Mr. Chairman and Members. I am Garry Mauro, the Texas Land Commissioner. I am pleased to appear before you this morning and would like to thank the Committee for this opportunity to discuss with you the problem of marine debris, particularly as it relates to Texas beaches. I will outline some of the sources of the Texas beach litter problem and some of the actions we are taking at the state level; I will also address some actions that I believe to be taken, or at least considered, at the federal and international levels to alleviate this problem.

Mr. Chairman, I would ask that the full text of my written statement, with attachments, be included in the record. I will summarize the key points of my statement and will be happy to answer any questions that the Committee might have.

Ralph Waldo Emerson once said, "The health of the eye demands a horizon." To American eyes, no horizon conveys a greater sense of well-being than the juncture of land and sea. Our shorelines are wildly varied. In the Pacific, molten lava sets off fireworks of steam, spraying glass-like particles that the surf pounds into the black sand beaches of Hawaii. Along Washington's Boundary Bar, the cliffs, beaches, and gravel pits originated with the drift deposits of glaciers. Some Oregon beaches are grayish-green with basalt. Dramatic cliffs and shale and sandstone boulders command two-thirds of the California sand-and-shell barrier islands of Texas to the silt jetties of the Mississippi Delta to the mangrove marshes along the curve of Florida. On the Atlantic, a pattern of sand promontories, barrier islands, lagoons, and marshes extends from Cape Cod to Cape Canaveral; ancient forests grow right up to the dunes from Fire Island, New York, to Cumberland Island, Georgia. But increasingly, our extravagant coasts have an outrageous and demeaning thing in common: they are rapidly being fouled by the world's garbage.

My state of Texas is blessed with 377 miles of Gulf coastline including many beautiful white sand beaches. Those beaches provide recreation for Texans, attract tourists to our state, and contribute to the crucial habitat of our aquatic wildlife. However, garbage dumping, particularly from ships and vessels operating in the Gulf of Mexico, is wreaking environmental and economic havoc on the State of Texas. Tourism is now our second largest industry, and Texas beaches are a major attraction to tourists; consequently, the garbage that fouls those beaches has become a major economic concern. Texas coastal cities and counties currently spend more than $14 million annually just to pick up trash off our beaches. And despite the Herculean efforts of those local officials, many tourists leave Texas beaches disgusted by the filth they find there. Tourists spent over $16 billion in Texas last year. While only 18 of

Texas' 254 counties border the Gulf of Mexico, over one-third of tourist dollars are spent and about one-third of the state's tourism jobs are located there. Visitors to our coastal areas obviously enhance the entire Texas economy.

A major reason for the severity of the beach garbage problem in Texas is the shallow, closed nature of the Gulf of Mexico. The tons of garbage dumped into the Gulf daily have a major detrimental effect on our ocean and coastal environment. Not only are fish, turtles, porpoises, birds and other wildlife dying in large numbers because of ingestion of and entanglement in the debris, particularly plastics, which pollutes their environment; our rookeries, bays, estuaries and other wildlife and marine life habitats are being seriously degraded by this inexcusable practice. Diving for fish, pelicans get tangled in plastic fishing lines and choke to death. In one noted incident, an infant pygmy whale washed ashore in Texas and died eleven days later of severe abdominal infection; in its stomach were a plastic bread wrapper, a corn chip bag, and a 30-gallon plastic garbage can liner. Sea turtles with entangled or mutilated flippers are far too common. Institutional dumping of garbage from ships and other vessels in the Gulf of Mexico and other areas of our marine environment must be stopped. Our beaches, many of which have more accumulated garbage than some cities, must be cleaned. And our wildlife and marine life habitat must be protected.

Speaking at the signing of the Water Quality Act of 1965, an angry President Lyndon Johnson said, "[t]he clear, fresh waters that were our national heritage have become dumping grounds for garbage and filth. They poison our fish; they breed disease; they despoil our landscape."

He continued, "[t]here is no excuse for a river flowing red with blood from slaughterhouses. There is no excuse for papermills pouring tons of sulfuric acid into the lakes and the streams of the people of this country. There is no excuse—and we should call a spade a spade—for chemical companies and oil refineries using our major rivers as pipelines for toxic wastes."

Were he alive today, I believe President Johnson would be equally angered by the currently legal and accepted practice of institutional dumping of garbage in our ocean by the world's shipping fleet and the resulting fouling of our beaches and coastal waters.

Let me begin by outlining for the Committee some of the issues that must be addressed in order to effectively deal with institutional dumping of garbage from ships and vessels in our marine environment. I would first like to discuss the particular problems of the Gulf of Mexico and of Texas.

THE GULF OF MEXICO: THE AMERICAN SEA

The Gulf of Mexico is an especially important resource to the nation. The United States encloses the Gulf of Mexico on three sides. With a generalized coastline of 1,631 miles, the Gulf coastline is longer than the entire Pacific coast of California, Oregon, and Washington, and is equivalent to the distance from Newport to Miami along the Atlantic coast. Thus the U.S. derives a major benefit from the Gulf, and has the major responsibility for its management. The U.S. actively exploits its remarkable marine resources, both biological and mineral.

The Gulf of Mexico is an exceptionally productive sea, annually yielding over 2.5 billion pounds of fish and shellfish which represents approximately 40% of the total domestic commercial fisher landings. Four of the top five commercial fishery ports in the nation by weight, and six of the top ten ports by volume, are located on the Gulf of Mexico. The Gulf is also one of the few areas of the U.S. Exclusive Economic Zone which still harbors large quantities of unexploited fishery resources. The Gulf supports over one-third of the nation's marine recreational fishing, hosting 2.3 million fishermen who in 1984 made 16.4 million fishing trips.

The coastal estuaries, wetlands, and barrier islands provide important habitat for large populations of wildlife, including waterfowl, shorebirds, and colonial nesting seabirds. For example, the Gulf provides critical habitat for 75% of the migratory waterfowl traversing the U.S. and the extensive coastal wetlands of the Gulf comprise about half of the national total.

Also, the Gulf of Mexico has been and will continue to be critical to the nation's energy supply. More than 72% of the oil and 97% of the gas produced offshore has come from the Gulf. More than $56 billion in Federal revenues were generated between 1956 and 1983 as a result of Outer Continental Shelf (OCS) oil and gas development there. OCS leasing is second only to the Federal Income Tax as a revenue source for the U.S. Treasury. The Department of the Interior estimates that 78% of the oil and gas potentially available from the U.S. Outer Continental Shelf will be found in the Gulf of Mexico.

The Gulf is also vital to the nation's trade interests. Approximately 45% of U.S. export/import tonnage passes through Gulf ports, including three of the top five commercial ports in the country. Recently, the policy of homeporting portions of the Atlantic naval fleet throughout the Gulf has increased pressures on ports and waterways. The need to develop and maintain ports that are strategically critical to the nation's trade and defense interests requires extensive harbor and navigation dredging. In 1986, this vital maintenance activity nationwide produced 60 million cubic yards of dredged material and 70% of this was deposited in the waters and coastal areas of the Gulf. Homeporting could easily double this amount, as well as add signficantly to the marine debris problem, particularly if the U.S. Navy continues its current practice of ocean dumping of all of its ship-generated garbage.

While the human population of the Gulf coast has been historically very sparse in comparison to the northeastern and southeastern coasts of the U.S., this is rapidly changing. Gulf states accounted for 35% of the U.S. population growth between 1980 and 1985. From 1970 to 1980 the population in coastal counties along the Gulf increased by 35%.

The waters of the Gulf of Mexico are affected by activities throughout much of the nation. Over 50% of the area of the contiguous United States drains into the Gulf. Thus, society's nutrients, wastes, and soils from Helena to Atlanta, from Albuquerque to Pittsburgh, and from Chicago to Tampa, eventually are washed into the Gulf of Mexico.

In short, the Gulf of Mexico provides an impressive wealth of resources to the United States and presents comparably great responsibilities to the nation. Therefore, the continued health and productivity of the Gulf must become a national priority.

ORIGINS OF GARBAGE ON TEXAS BEACHES

Texas beach debris has two obvious sources: that coming ashore from the Gulf of Mexico and that generated on land. A 1985 Texas Coastal and Marine Council report (copy attached) estimates that 75% to 90% of the trash on Texas beaches comes from offshore sources. The remaining 10% to 25% is deposited by beach visitors and onshore trash dumpers. A 1975 report by the National Academy of Sciences indicates that the vast majority of offshore debris originates from ships and vessels—passenger ships, merchant ships, recreational boats, commercial fishing and shrimping boats, oil and gas platforms, supply boats, seismic and military vessels.

The recent odyssey of the now infamous Islip, New York garbage barge, the Break of Dawn, helped to raise in a dramatic way the nation's consciousness about the problems of disposing of our society's wastes.

However, the 3,186 tons of municipal garbage contained on that barge is a mere drop in the proverbial bucket compared to the garbage routinely and legally disposed of by the world's shipping fleets in our oceans. The worldwide rate of waste disposal in our oceans from offshore sources was estimated in the early 1970's by the National Academy of Sciences at 14 billion pounds per year. The world's merchant shipping fleet discards at least 4,800,000 metal, 300,000 glass, and 450,000 plastic containers at sea each day. And recreational boaters are estimated to generate one pound of trash per person each day. U.S. naval ships, which routinely dispose of their trash at sea, by the Navy's own estimate generate over 3 pounds of solid waste per man each day and some crews number over 5,000 men.

Careless expedience accounts for much of the dumping. Also, the U.S. Department of Agriculture, fearing entry of fruit flies and other foreign microbes, prohibits foreign ships from disposing of garbage in our ports unless it has been burned or steam-sterilized. But few ships are equipped to meet those standards, and few U.S. ports currently have USDA approved facilities for waste disposal. According to the most recent USDA figures, of 73,614 foreign ship landings in American ports last year, only 1,731 resulted in off-loading of any garbage. Only 90 of those off-loadings occurred in Texas ports. Thus, it is clear that virtually all shipping garbage gets dumped at sea!

Direct ocean dumping of debris from land-based sources and indirect sources, such as rivers, streams and land run-off, deposit more trash in the Gulf. Oil and gas rigs and platforms and the supply vessels that support them contribute to the problem. At present, only 104 oil and gas drilling or production platforms are located in state waters off the Texas coast, and only 9 of those are manned. Federal waters off the Texas coast are dotted with another 295 platforms. However, the offshore platforms in state and Federal waters off Louisiana number over 3,100. Those platforms are serviced by over 800 vessels including cargo boats, standby boats, field service boats and crew boats as well as the seismic vessels operating in the Gulf.

For our purposes, it is useful here to differentiate between "garbage" and "solid waste." Garbage may be defined as organic waste, such as unused food, that decomposes or is eaten by fish in the sea. Solid waste is non-organic, man-made material that does not biodegrade: plastics, metal, glass, packing materials, styrofoam, etc.

Offshore dumping of solid waste imperils all American shorelines—Atlantic, Pacific, and Gulf. The problem is particularly acute in Texas because our coast is the natural dumping point for the northern and southern longshore current complex. These currents sweep the entire eastern portion of the Gulf of Mexico and converge on a 10-mile (27 degrees N Lat.) stretch of beach in the middle of Padre Island National Seashore near Corpus Christi, Texas. These currents which transport the sand necessary to make our beautiful beaches also transport and deposit both floating and subsurface suspended debris all along Texas beaches north and south of this convergence zone. A map of these currents (copy attached) will quickly show you why any solution to the Texas beach garbage problem must deal with all sources of garbage dumped anywhere in the Gulf of Mexico. The currents ensure that solid waste discharged from oil and gas platforms off Louisiana or from shipping off Mexico has a very good chance of ending up on a Texas beach. Texas beach garbage, however, is not just a local or regional problem, and any solutions must be national and international in scope.

TYPES OF BEACH LITTER

Beach litter obviously includes many natural products such as trees, driftwood, fish, birds, shells, sargassum weed and other natural refuse. The aesthetic and environmental consequences of this type of litter are usually not major because of their natural origins. In contrast, man-made debris and trash, particularly plastic and glass materials, are clearly more objectionable and pose a greater environmental hazard. The cumulative evidence of the non-degradable nature of man-made objects makes such debris aesthetically and evironmentally unacceptable. Some plastics may take over 400 years to decompose. Beach garbage reflects a continuing tradition of mankind's use of the oceans as vast sinks for the disposal of its wastes. Man-made non-degradable items are the major components of the debris cluttering Texas beaches and ultimately, can only be controlled at their sources.

Three types of litter have become a particular source of concern:

Long-lasting plastic items, such as bags, sheeting, nets, strapping bands, six pack rings, computer tape rings, fishing lines, and pellets, many of which are hazardous to marine life and shore birds.

Drums of hazardous chemicals either illegally dumped or accidentally dropped into the sea.

Styrofoam, glass, metals, and other man-made, non-degradable items.

ACTIONS TAKEN BY THE STATE OF TEXAS TO HELP ALLEVIATE THE PROBLEM

On September 20, 1986, I participated in a coastwide beach cleanup in Texas sponsored by the Center for Environmental Education. On that day 2,800 volunteers picked up over 124 tons of garbage off 122 miles of Texas beaches in just three hours. On April 25 of this year over 3,600 volunteers picked up an additional 140 tons of trash from 150 miles of Texas beaches. That should give you some idea of the magnitude of our problem!

Innovative action at the state level can aid in alleviating this problem, and the State of Texas has begun to do its share. The Texas General Land Office has revised its regulations (copy attached) and its lease contracts governing submerged lands off the Texas coast to prohibit discharges of solid wastes from oil and gas drilling and production platforms and from seismic vessels operating in state waters. We have asked oil and gas operators in state waters to present detailed solid waste management plans. We want to know how these companies propose to collect, store, transport, and dispose of the trash generated on platforms and supply vessels. Flexibility of planning is in our common interest, thus different methods of disposal are acceptable. But once these companies have devised solid waste management plans, they must strictly comply with them. Companies engaged in offshore energy activity in Texas waters may now expect to have their state operating permits or leases canceled if they dump solid wastes into the Gulf of Mexico. Texas General Land Office inspectors now routinely inspect offshore operations to insure that no solid waste is being dumped from oil and gas platforms or seismic or supply vessels.

The Texas Department of Highways and Public Transportation has launched a high-profile and highly successful "Don't Mess With Texas" anti-litter public relations campaign. That campaign has been credited with a 34% reduction in highway litter since its inception and has dramatically raised the public consciousness of

litter problems in general. As a part of the "Don't Mess With Texas" campaign, public service television advertisements were filmed on Texas beaches to focus specific attention on the beach litter problem. We at the Texas General Land Office have taken that public awareness campaign one step further, by initiating our own "Don't Mess With Texas Beaches" campaign to help in restoring our beaches as playgrounds rather than dumping grounds.

Other steps taken should have a significant impact in both the short term and the long term. We have assembled a group of interested citizens who have devised and are implementing the Texas Adopt-A-Beach Program. (guidelines attached) This program asks civic groups, corporations, and individuals to assist in cleaning up the hundreds of tons of debris currently covering our Texas beaches by "adopting" a particular segment of beach and agreeing to clean it a minimum of three times a year. The program, operated at the local level through volunteer county coordinators, will not only go a long way toward cleaning up the existing filth on Texas beaches; it will also help to stay abreast of the new tides of debris that wash ashore each day. At present 138 miles of Texas beach have been adopted by 98 groups. This amounts to over 70% of the accessible beaches in our state. However, all concerned recognize that Adopt-A-Beach is only a short term answer.

I am very pleased with the response to both our new regulations regarding offshore oil and gas activity and to our Adopt-A-Beach program. But even if completely successful, these programs can deal with only about 20% to 40% of the debris on Texas beaches. Mr. Chairman, the remaining 60% to 80% can only be dealt with by federal and international action.

Over the long haul, solid waste must be kept out of the water. Institutional dumping in the oceans must no longer be tolerated. Numerous studies, as well as the analysis by the Center for Environmental Education (copy attached) of the trash collected during the Coast Week beach cleanup last September, confirm that most of the debris on Texas beaches originates offshore. It is estimated that only 10% to 15% has come from offshore oil and gas operations, and with the combined efforts of the Texas General Land Office, the U.S. Minerals Management Service, and the oil and gas operators themselves, that percentage is being rapidly reduced. Similar cooperative action must be taken to stop garbage dumping from ships and other vessels.

As you know, the Senate is currently considering ratification of a treaty known as Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL-Treaty Document No. 100-3). This treaty basically does four things: (1) it prohibits the ocean disposal of all plastics, (2) it prohibits the disposal of other floating solid wastes within 25 miles of the nearest coastline, (3) it requires that garbage disposal facilities be provided at all ports and (4) it designates certain "special areas" where no solid waste dumping is allowed. The presently designated "special areas" are the Mediterranean, Red, Black, and Baltic Seas and the Persian/Oman Gulfs: all shallow, closed basins with heavy shipping traffic.

The Gulf of Mexico, which shares these same characteristics, is not currently designated as a "special area." However, we hope to change that in the near future. At the February meeting of the International Maritime Organization in London, the U.S. delegation announced its intention to present an amendment to Annex V to designate the Gulf of Mexico as a "special area." That amendment will be considered by IMO at its December 1987 meeting. The Texas General Land Office has contracted with the Center for Environmental Education to provide the scientific study necessary to document the need for a "special area" designation. The first draft of this study has been completed and is currently being reviewed by the U.S. Coast Guard, the National Oceanic and Atmospheric Administration, the Minerals Management Service, the U.S. Department of Agriculture and other appropriate parties prior to its submission to IMO in September to ensure that an accurate and adequate case is made in support of the amendment request.

Organizational support for "special area" designation for the Gulf, as well as ratification of Annex V and passage of effective implementation legislation has been formally expressed by several important groups. At its May meeting in Seattle, the Coastal States Organization, which is comprised of the gubernatorially appointed representatives of the 35 coastal states, commonwealths and territories, unanimously passed such a resolution. (copy attached) In January the 23 state land commissioners who make up the Western States Land Commissioners Association passed a similar resolution, (copy attached) as did the National Wildlife Federation at its March membership meeting and the Sportsmen's Clubs of Texas at its April annual meeting.

POSSIBLE SOLUTIONS

The marine debris problem exists in part because of the lack of clear jurisdiction over the issue by any state or federal agency. Also, a myriad of laws, treaties, and regulations complicate the problem. No one, it seems, Mr. Chairman, has been able to pull together all of the various Federal agencies involved to formulate a comprehensive plan of action. The implementation legislation currently under consideration by this Committee is clearly a significant step toward establishing such coordinated action and the Committee is to be commended for this demonstration of strong leadership on this important subject. I know that you will continue to press for implementation of a comprehensive plan to remedy all aspects of this problem. I pledge to you that we in Texas will do all in our power to assist with that effort.

I do not claim to have all the answers to this complex problem. However, I would like to take this opportunity to raise some specific issues that I believe need to be addressed. Probably the most important and difficult issue concerns how to accomplish the United States Department of Agriculture's legitimate goal of keeping harmful foreign insects and microbes out of this country without encouraging ships to dump their garbage in the ocean before entering U.S. waters. This ocean dumping of solid waste to avoid USDA inspection clearly spoils our beaches and may also be allowing some of those insects and germs to wash ashore. It has been speculated that fire ants may have been introduced into this country by floating in on garbage dumped from foreign ships. That *must* change—not only to protect our beaches but also to guarantee that pestilent insects and germs do not invade this country.

Clearly, flexibility of planning and regulation is in our nation's interest. Let us assume that the Senate ratifies Annex V of the MARPOL treaty and that sufficient number of shipping nations follow suit to make the treaty international maritime law. Let us further hope that the Gulf of Mexico is designated as a "special area" under Annex V. That would mean that ships could no longer discharge plastics in any ocean. They could discharge other floating solid waste no closer than 25 miles from Atlantic and Pacific shores, and within the closed Gulf of Mexico, they could not dump any kind of solid waste at all.

Those requirements are not unreasonable; in ratifying Annex V, 27 countries have already accepted the equivalent difference between managing garbage and debris in the Indian Ocean and managing it in the Mediterranean Sea. But the different requirements do impose different demands.

The answer, perhaps, is a framework of solid waste management plans similar to those developed by the State of Texas and its client offshore oil and gas producers. Each ship should be required to devise and strictly adhere to a plan for disposal of its solid waste, taking into consideration ship design and function, crew size, port differences and all other relevant variables.

To make any solid waste management plan work, however, facilities to steam-sterilize or incinerate ship garbage must be available. The question is how they should be provided. Ships could be required or encouraged to install shipboard incinerators. Some already have and are currently utilizing such onboard facilities. However, for most ships, the provision of facilities in each port to allow those ships to off-load their garbage for proper processing and disposal, coupled with a legal requirement for such off-loading, would appear to be a more logical and practical alternative. After all, there are only three ways to dispose of ship-generated solid waste: (1) on board incineration, (2) off-loading in port or (3) dumping in the ocean. Since we have agreed that the latter is no longer an acceptable method of disposal, our task is to determine how to implement a plan for either on-board incineration or off-loading and proper disposal.

As you are well aware, Mr. Chairman, both the states and the Federal Government are experiencing significant budgetary problems. Therefore, any solid waste management plan which would require significant outlays of public money to provide disposal facilities in port is not likely to succeed. At present, the USDA has approved and supervises plans for dispoal of garbage from international flights at all major international airports. In most cases, this is done on a contractual basis by the airlines and private-sector waste management companies. This method accomplishes USDA's legitimate objective of keeping pestilent insects and foreign microbes out of the U.S. and does so without significant economic burden to either the garbage generator (in this case, the airline) or the American taxpayer. I see no reason, Mr. Chairman, why a similar cost-efficient, common sense program could not be established to deal with ship-generated garbage at American ports.

The next significant question becomes how to ensure that ships actually off-load their garbage for proper disposal rather than continuing their current practice of dumping it at sea. The prospect of the Coast Guard or any other agency patrolling

the merchant shipping or fishing fleets in order to ticket garbage dumpers seems to me quite impractical. First, the Coast Guard has higher priorities, such as interdiction of drug traffic, and actually catching ships who dump their garbage in the middle of the night would be a most difficult if not impossible assignment. Additionally, even if a violator was apprehended and ticketed, use of the federal criminal justice system to convict and punish garbage dumpers would only add another burden to an already overburdened system. The most likely result would be to ensure that no real deterrence would occur.

However, an administrative requirement that, as a part of the port entry process, a ship be required to present and off-load its garbage, or to produce acceptable evidence that its garbage either has been properly incinerated in shipboard incineration facilities, or previously off-loaded at a certified reception facility seems to me to present a reasonable, workable alternative. The specific outlines of such a requirement should, in my view, be the subject of administrative rules promulgated by the proper enforcement agency and should provide for a reasonable, subjective assessment by the enforcing agency of a ship's compliance with its solid waste management plan. A ship captain should be required to make a daily entry in the ship's log noting the time of its daily garbage disposal and certifying that the disposal has been done in accordance with Annex V and U.S. law.

The objective of such requirements is to provide incentives for changing a long-standing behavioral pattern in the maritime industry. For thousands of years, ships have routinely disposed of their garbage in the world's oceans. The prevailing adages have been "out of sight, out of mind" and "the solution to pollution is dilution." What we have learned, however, is that like most easy answers, these simple "solutions" do not work.

Education about the true impact of ocean disposal of ship garbage must be an integral part of any long-term effort to eliminate this problem. We must change behavioral patterns that have been accepted for centuries. Incentives for changing those established patterns of behavior must be provided and, as in most cases, some of those incentives can be negative, but most must be positive. Users of our marine environment must be educated about the consequences of their actions and encouraged to change their ways. Such an effort must have the full support and active participation of the affected industries as well as all levels of government and an informed public. Both ocean dumping and beach littering must be made unacceptable and unprofitable behavior. It is time to stop bemoaning what a difficult problem we face and pointing fingers at other offenders and instead begin to take aggressive, positive steps toward solving the problem.

I earlier compared our current situation regarding ocean dumping of garbage from ships to the situation we faced in the 1960's regarding inland water pollution. At that time, as you remember, it was common practice for our cities and industries to have open sewers running into our streams, rivers and lakes. The first step in that pollution battle was to close those sewers and begin some kind of pre-discharge treatment. Technical fine tuning, such as effluent monitoring and regulation, came much later in the process. At this point, my primary concern is closing the open sewers. Each pound of garbage off-loaded in port is one pound our local cities and counties do not have to pick up off our beaches. The numerous options for workable and enforceable solid waste management plans will unfold once their necessity is acknowledged. Fine tuning of the procedures for off-loading and treatment can come at a later date, but we must begin to attack the problem seriously and now.

Mr. Chairman, we Texans like to think of ourselves as practical, commonsense problem solvers. We want to play a significant role in solving the problem of ocean dumping of garbage and marine debris. But because this problem is not just a Texas or a Gulf of Mexico problem, solving it will require national and international action. Annex V and its implementation legislation will provide the framework for those national and international solutions. With your help and your active support, one day soon clean oceans and clean beaches can again be a blessing and a way of life for all Americans. When that happens, the people of Texas and the rest of the country will have you to thank.

Thank you again for this opportunity to testify and for your attention. I will be happy to respond to any questions that you might have.

Senator BREAUX. Thank you, Mr. Mauro; a good statement.

Mr. McManus.

Mr. MCMANUS. Thank you, Mr. Chairman. I am Roger McManus, president of the Center for Environmental Education. My remarks today are on behalf of the 100,000 members and supporters of our

marine conservation organization who are deeply concerned about the growing plague of plastics in our oceans.

CEE conducts a variety of programs concerning endangered and threatened marine species and their habitats. For the past five years we have focused our attention on documenting the harmful effects of plastic debris in the marine environment, entanglement of marine wildlife in ocean debris, and incidental take of nontarget species in active fisheries.

We have been asked by the committee to lay out our findings and general sense of the problem of plastic pollution and to comment on ratification of Annex V of MARPOL protocol as one means to solve that problem. My remarks draw upon several studies conducted by the Center which have been made available to you.

It is increasingly clear that humankind is going to have to stop the age old practice of using the ocean for a garbage dump. For years we never saw the problem. The fish ate the food garbage, wood rotted away, metal and glass sank, and paper and cloth decayed. But now more manufactured objects are made of plastic, a material reknown for its light weight, strength and durability. The very characteristics that make plastic so useful make it a permanent and ubiquitous kind of marine debris.

In fact, plastic items are now the most common manmade objects sited at sea. It comes from merchant, commercial fishing, naval and passenger vessels, from recreational and sport boats, from careless beach goers, and from sewer and waste water treatment systems that are not designed to handle this floatable component of municipal waste.

All these sources dump, lose or flush nearly 13 billion pounds of plastic waste into the ocean every year, and it does not go away. The lowly six pack ring, on which much attention has been focused, may have a life span of 450 years.

Of course, the aesthetic problem of littered beaches is obvious. Manmade litter is not a new problem; however, the qualities that have made plastic so successful make plastic debris particularly persistent in the ocean. Since it floats, ocean currents transport it to shore. Even in remote areas of Anarctica, researchers find plastic bottles, bags and sheeting.

This accumulation of debris is not only unsightly, it is costly to the coastal communities who have to clean it up. Ultimately, it is costly to the economies of communities that depend on tourism because tourists will not come back to a messy beach.

But improperly disposed of plastic creates more than a litter problem. Plastic debris is killing thousands of marine animals every year by ensnaring and entangling and drowning seals, sea turtles and marine birds. Entanglement is not the only threat. Fifty of the world's 280 species of sea birds are known to ingest small pieces of plastic, and fish have been found with raw plastic pellets blocking their guts and intestines. Sea turtles and whales ingest and are killed by plastic bags and sheeting.

Persistent debris wastes fishery resources. The U.S. commercial fishing industry is losing millions of dollars each year to the effects of plastic debris: time wasted removing plastic trash from gear and

catch; engine disablements and damage from floating debris; and ghost fishing.

Derelict fishing gear, once lost or discarded, continues indefinitely to capture and waste fish that will never be harvested. Millions of pounds of lobster, crab, salmon and other valuable species are ensnared and rot, baiting the derelict traps and nets to capture yet more and more fish and shellfish.

What is the answer to getting rid of this harmful debris? That is where we have been directing our efforts most recently. Our biggest emphasis has been on educating those who are the sources. By conducting the largest beach cleanup in the Nation, we not only gathered up more than a ton per mile of trash from the Texas coastline, we made citizens and decisionmakers aware of the problem.

Through a multimedia campaign directed at merchant shippers, commercial fishermen and plastic manufacturers, we are aiming to make those who are part of the problem part of the solution.

These are just two projects that focus on education, the people problem and marine debris. They are not enough. The widespread and ever-increasing presence of marine debris in our oceans is going to require the attention, resources and problem solving ingenuity of business, industry, government and citizenry alike.

Other approaches include regulation of debris items themselves; for example, requiring that all six pack rings be degradable or studying the feasibility of making degradable fishing gear, particularly trap fasteners. These approaches have merit, but only if they focus on those items known to cause a problem for marine species. It is neither practical nor desirable to require that all plastics be degradable.

Another regulatory approach is to control the disposal of plastics. MARPOL Annex V would do just that by prohibiting ocean disposal of plastics and by limiting disposal of other waste to certain distances from land. We look forward to advice and consent of the Senate to ratification of this international agreement.

In implementing Annex V in the U.S., any scheme that is going to work must take into consideration the diversity of vessel types and the vast differences in our system of ports and harbors. Implementation must provide incentives to bring plastic trash back to port, procedures and facilities that make it reasonable and economical for ships and ports to handle the trash, and the means and resources for government to enforce compliance with the law.

CEE believes that presentation of trash is an important requirement for vessels of more than 1,000 tons gross weight to be waived only upon evidence of onboard incineration or verification of proper ocean disposal by recordkeeping in an onboard log book.

We support dockage fees to help ports cover the cost of waste disposal as well as provisions for citizen suits and rewards from penalties for violations to those who help apprehend the violator.

Mr. Chairman, I think that it is very important in a difficult enforcement situation like this that we take advantage of every opportunity that we have. There are literally thousands of merchant vessels, recreational vessels and commercial fishing vessels out at sea who have a vested interest in keeping the ocean clean, and

they should be enlisted in the effort to insure that MARPOL Annex V is enforced.

Our written testimony has details on these proposals, and I would be pleased to answer your questions concerning these items.

In closing, I would like to emphasize again the importance of bringing all the U.S. expertise we have available to focus on this problem. Perhaps the task force which many members of this committee asked the President to appoint will provide a leadership role; or that role may be played by the National Oceanic and Atmospheric Administration, which now has the only Federal program directly targeted on the marine debris issue.

Whatever form your approach takes, we urge you to make clear your commitment to forging a national policy that will implement a comprehensive program for keeping plastic trash out of the ocean.

I would like to make one further note in this summary, Mr. Chairman, with regard to Navy policies, which I do think can be further improved. There is a lot of emphasis on throwing garbage overboard that will sink. This is not a solution. This is just getting it out of view. That sinking garbage will still be a problem for marine wildlife, and with respect to disposal in certain areas such as the Gulf of Mexico, does sinking garbage not mean that it will go away.

We have recorded, and there is much evidence, that very, very large and heavy objects disposed of in the Gulf of Mexico will be washed ashore by very strong currents that exist there. Full containers of toxic waste have been found on the beaches, as well as large concrete and metal objects that were obviously disposed of at sea and have found their way up on the beaches through the currents.

So if the U.S. Navy plans on disposing of its garbage in the Gulf of Mexico by making it sink, we can look forward to enjoying it on the beaches probably appropriately identified as U.S. government trash.

Thank you.

[The statement follows:]

STATEMENT OF THE CENTER FOR ENVIRONMENTAL EDUCATION

My name is Roger E. McManus. I am testifying as president of the Center for Environmental Education (CEE), a private, non-profit marine conservation organization, and on behalf of its 100,000 members. CEE has for many years been concerned about the effects of man's activities in ocean environments. CEE conducts a variety of programs concerning endangered and threatened marine species and their habitats, nonrenewable and renewable marine resources, and marine pollution. For the past five years the Center has focused attention on documenting the harmful effects of plastic debris in the marine environment, entanglement of marine species in ocean debris, and incidental take of nontarget species in active fisheries.

We have been asked by the Committee to lay out our findings and general sense of the problem of plastic pollution, and to comment on ratification of Annex V of the MARPOL Protocol as one means to solve that problem. My comments on our documentation of the problems of marine debris, entanglement and incidental take are drawn from several published reports which have been provided to you along with copies of this testimony. Our comments on Annex V will deal with incentives to compliance, procedures and facilities for implementation, and the means and resources to enable enforcement.

PLASTICS IN THE OCEAN: MORE THAN A LITTER PROBLEM

Man has for centuries used the ocean as a means of transportation, a producer of food, a source of mineral wealth. Unfortunately, man has also used the world's oceans as a receptacle for all types of garbage. For years we never saw the problem—metal and glass sank, paper and cloth decayed. But now, more and more manufactured objects are made of plastic—a material renowned for its light weight, strength, and durability. Today the effect of dumping plastics into the ocean has become an all too visible problem.

While the U.S. plastics industry has been in existence for over a century, the commercial development of today's major plastic materials occurred during World War II when shortages of rubber and other materials brought plastics into great demand. By 1960, approximately 6.3 billion pounds of plastic resin were produced in the United States. Present plastics production has increased to nearly 50 billion pounds per year.

Even more notable is the growth of plastic's applications. The convenience of plastic for consumer products and packaging is demonstrated by the fact that in 1984, the U.S. produced more than 17 billion plastic bottles and turned out nearly 1 billion pounds of plastic trash bags. Lightweight plastic has enabled fishermen to use nets that may extend over 20 miles in length and traps that are easy to handle and require little maintenance. Its strength has made plastic an ideal substitute for other materials used in packaging heavy cargo. For instance, plastic is rapidly replacing steel in the manufacture of strapping bands used to bind crates. In 1984, some 300 million pounds of plastic were used in shipping sacks and pallet shrink wrap. Above all, plastics are durable. A simple plastic six pack ring used for carrying beverages has an estimated life span of 450 years.

Major markets for plastic goods include transportation, packaging, construction, electrical and electronics, furniture and furnishings, consumer and institutional supplies, industry and machinery. In essence, plastics have been incorporated into virtually every industrial and commercial sector of America.

What happens to plastic goods when their useful life is over?

It's a common practice for oceangoing vessels to throw their wastes overboard while at sea. According to a National Academy of Sciences estimate made over decade ago, oceangoing vessels discard 14 billion pounds of cargo and crew wastes, including plastics, every year. Added to this amount is little disposed of on land, and eventually washed into aquatic areas via rivers, sewer systems, landfills and other sources. But while some litter sinks or rapidly decays, plastics dumped into the ocean simply accumulate—in fact, plastics are now the most common man-made objects sighted at sea.

Where are these plastic wastes coming from?

The world's merchant shipping fleet discards at least 450,000 plastic containers, in addition to 4,800,000 metal, and 300,000 glass containers into the sea every day.

Merchant ships dump into the oceans more than 12.4 billion pounds of cargo wastes, includng plastic sheeting and strapping bands, every year.

The world's commercial fishing fleets jettison more than 50 million pounds of plastic packaging and millions of pounds of plastic fishing gear including nets, rope and buoys every year.

Recreational and sport fishing vessels discard more than 100 thousand pounds of plastic bottles, bags and other garbage into U.S. coastal waters each year.

In the metropolitan Northeast, sewer systems combined with stormwater runoff systems overflow when their capacity is exceeded during heavy rainfall—flushing into the oceans plastic tampon applicators, condoms, thin pieces of plastic sheeting from sanitary napkins and disposable diapers.

Some municipal wastewater treatment plants discharge plastics directly from both primary and secondary sewage treatment plants, or dump floatable plastics along with treated sewage sludge. In the late 1970's, as estimated 1,000 plastic tampon applicators were dumped with sewage sludge in the New York Bight every day. Today the amount is thought to be considerably higher.

Not only are plastic objects prevalent at sea, but researchers are finding that tiny plastic pellets, the feedstock of the plastics industry, have become ubiquitous component of marine litter. Plastic pellets are the raw form of plastic after it has been manufactured from petrochemicals and before it is molded into plastic products. These pellets probably enter the ocean via rivers near outfalls of plastic manufacturing and processing plants or by escapement during transportation. Although the amount of pellets entering the sea each year is unknown, concentrations have been measured to range from 34,000 pellets per square kilometer on the ocean surface to 20,000 per square meter on beaches. One company has reported that by installing

special equipment, they reclaim about 5 million pellets each day that would otherwise escape into marine areas.

Why should we be concerned about this persistent debris?

While most man-made debris can create aesthetic or environmental problems, the qualities that have made plastics so successful make plastic debris a particular threat in the ocean. Since much plastic floats, ocean currents transport it to shore. Even in remote areas of Antarctica researchers now find plastic bottles, bags and sheeting washing ashore.

This accumulation of plastic debris is not why unsightly—it's costly. Coastal communities bear the burden of aesthetic degradation resulting in lost tourism revenues and costly cleanup procedures. Texans spend $4,000 per mile per year to remove beach litter that washes ashore from the Gulf of Mexico. But improperly disposed plastics create more than a litter problem.

PERSISTENT DEBRIS KILLS MARINE WILDLIFE

Plastic debris is killing thousands of marine animals every year. Seals that investigate floating plastics become entangled, and strangle in objects such as strapping bands and net fragments. Up to 30,000 northern fur seals die this way each year. Sea turtles accidentally swim into lost pieces of rope, fishing line of other objects and drown. And birds not only become entangled in plastics such as 6-pack rings and fishing line, but collect plastic trash for nest materials creating death traps for their young.

But entanglement is not the only threat—marine wildlife eat plastic items mistaken for food causing internal injury, intestinal blockage, and starvation. Fifty of the world's 280 species of seabirds are known to ingest small pieces of plastic, especially raw plastic pellets. Fish have been found with raw plastic pellets blocking their guts and intestines. Sea turtles often mistake bags and sheeting for jellyfish, a favorite prey item. Even the great whales are victims—one was found with more than 4 dozen plastic bags impacted in its stomach.

The threat plastic debris poses for marine animals is compounded by the fact that many affected species, such as sea turtles, already face extinction from human caused factors. And while plastic debris has been shown to affect a variety of wildlife, we don't yet know its broader impacts on marine populations, communities or ecosystems.

PERSISTENT DEBRIS WASTES FISHERY RESOURCES

The U.S. fishing industry is losing millions of dollars each year due to plastic debris. Not only is time wasted in removing plastic trash from fishing gear and catch, but higher costs are associated with derelict fishing gear that because of its durability continues to catch and waste fish indefinitely. For example, the New England lobster fishery loses over 500,000 traps per year. The "ghost fishing" by these synthetic traps results in the annual loss of more than million pounds of lobster.

In the western Gulf of Alaska, more than 30,000 king and tanner crab traps have been lost since 1960. Fish and shellfish in these traps become bait for others thus sustaining a never-ending cycle of ghost fishing throughout the lifetime of the trap. Derelict nets that remain suspended by buoys or snag on the bottom also continue to catch fish. One abandoned gillnet recovered in the North Pacific measured over 9 miles. Entangled in the webbing were hundreds of salmon. Hundreds more probably had become ensnared and dropped out of the net before it was found.

PERSISTENT DEBRIS ENDANGERS HUMAN SAFETY

Plastic debris in the form of fishing nets, line, bags and sheeting are floating menaces that foul propellers and clog engine intakes. While statistics have not been gathered on the frequency of these occurrences, vessel disablements of this type are reported nationwide. Garbage bags are considered to be the leading external cause of engine disablement in the North Atlantic. In the Gulf of Mexico, large pieces of plastic sheeting discarded by offshore petroleum and merchant shipping industries often disable vessels. In some instances, seafarers have attributed fatalities, particularly in the Bering Sea, to disablements of this type.

Most recently, though, CEE's efforts have focused not on describing the problem, but on exploring and implementing solutions. The Center's primary emphasis has been on educating those who contribute to marine debris, so that they can take a hand in reducing the problem. Last September, CEE organized the largest volunteer beach clean-up ever conducted in the U.S. Thousands of volunteers walked 122 miles of Texas beach and picked up 124 tons of trash. Information from that collection is

being used now to analyze where Texas beach trash comes from, and how we might get rid of it. Currently, CEE staff are working with the federal government and the plastics industry to produce a major, multi-media education program aimed at merchant shippers, commercial fishermen, and plastics manufacturers. We participate in a number of national marine debris forums designed to explore ideas from plastics degradability to garbage "log books" aboard merchant vessels to rewards for tournament anglers who "bring back the most trash."

If our involvement has led to any conclusion, it is this: marine debris is a widespread, long-lasting, and costly problem that requires the attention, resources, and problem solving ingenuity of business, industry, government, and citizenry alike. There is no lone solution, no single approach, no sole industry that can provide the whole answer. Our ideas for solving the problem must be as diverse as the problem itself.

What are some of the present ideas for solutions?

Several pieces of legislation which would require degradability for certain kinds of plastic products or control their disposal have been introduced by this body and in the House. Most of these proposals also call for studies and research. A number of the members of this committee were signatory to a letter asking the President to create an interagency task force federal attention on persistent marine debris.

The Marine Entanglement Research Program in the National Marine Fisheries Service is now in its third year, and has generated a tremendous amount of new information on the issue, as well as created what appears to be a highly successful cooperative education effort with commercial fishermen in the Pacific Northwest. The National Marine Pollution Program Office has elevated the issue from nearly last on its list of national marine pollution issues to among the top 10. At a recent workshop on the issue, NMPPO brought together experts from federal and state governments, the commercial and sport fishing industries, merchant shipping, the Navy, academia, and conservation groups to set priorities for research on several plastic debris issues.

The plastics industry recently sponsored a symposium on degradables, and is underwriting nationwide education programs for their own members as well as other industrial sectors that contribute to the problem.

These efforts mark a promising beginning. They are the first steps toward getting the garbage out of our oceans. But they are just that—a beginning. What is needed now is a national policy that reflects our commitment to getting the job done.

A NATIONAL POLICY ON CURBING MARINE DEBRIS

In the past year, the United States has stepped up its efforts to ratify Annex V of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (Annex V). The ratification of this Annex is pending before the Senate Foreign Relations Committee now. Its prohibition on plastics disposal at sea will go a long way toward reducing the amount of persistent debris in our oceans. It is, however, not a panacea, because ocean disposal of shipboard waste is just one component of the problem.

Accidental loss of packing materials at sea, deliberate or accidental loss of fishing gear, sewage sludge disposal and waste treatment overflows, industrial wastes, runoffs from landfills, and littering all contribute to plastic in the oceans. This diversity of debris and its origins points up the need to look beyond the singular issue of ocean disposal of ship waste. It also demonstrates the need for a broad spectrum national approach that involves not just one, but several federal agencies.

What is required is a clear expression of Congressional intent that those agencies begin to tackle the problem, not by addressing issues like degradability or ocean dumping piecemeal, but by approaching the issue cooperatively and in its entirety. This means a Congressional mandate that we look at all the sources of persistent marine debris, and we apply all the existing authority, knowledge and expertise we have. Only then, we believe, will the agencies with the authority to handle the various component parts of the problem join the effort to develop an implement a coordinated and effective national policy for reducing marine debris and the harm it causes our oceans and coastlines.

CEE has one final comment in the context of setting a national policy for reducing harmful marine debris. The United States owns and operates hundreds of "public" vessels, which are exempted from the requirements of Annex V. Although we acknowledge special circumstances must be considered with regard to national security, it seems to us that the Navy, the Coast Guard, and NOAA should be held to a stricter standard than that provided in the various proposals to implement Annex V. We know, for example, that the National Oceanic and Atmospheric Ad-

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ministration already requires its vessels to dispose of wastes in a manner consistent with Annex V regulations. If the Navy and Coast Guard cannot comply, given their operational capabilities, then those capabilities should be examined.

We urge the Committee to call for a report to Congress, either through further Senate direction to the interagency task force you asked the President to form, or as a requirement of one of the many legislative proposals before you. This report, from the U.S. Navy, Coast Guard, and the NOAA, should provide information on: (1) the present practices of U.S. public vessels for disposing of shipboard wastes; (2) present capabilities of public vessels to handle on-board wastes by methods other than ocean disposal, (3) a status of best available shipboard waste-handling technology, (4) an estimation of the cost of outfitting U.S. public vessels with the best available technology, (5) an assessment of the capability of public vessels to comply with Annex V, and (6) an assessment of the feasibility of changing procurement and provisioning practices to reduce the amount of non-degradable plastics taken aboard vessels.

IMPLEMENTING ANNEX V: TECHNOLOGICAL AND REGULATORY SOLUTIONS

As we stated above, CEE believes that the real key to solving the marine debris problem is in educating those who use plastic materials and products on or near the oceans in how to dispose of them properly. However, there is some point at which government may have to step in to modify behavior through regulation when education is not enough. There are two tracks which such regulation could take: regulation of the debris items themselves, or regulation of those who use and dispose of them.

Using the first approach, it has been suggested that the government mandate degradability for all plastic products. While this may seem appealing as a "quick fix," CEE does not believe it provides the whole answer. In the first place, it does nothing to discourage the practice of using the ocean as a garbage can. If consumers and seafarers thought all plastic products were degradable, they would have no incentive to stop pitching wastes overboard or to carry them away from our beaches. Second, not all plastic products lend themselves to degradable applications. Finally, any requirement for degradability of plastic products should distinguish narrowly those products and items that are known to pose the most harm to marine organisms.

For example, we support measures in other pending legislation that would require that plastic beverages yokes ("six-pack rings," "loop connectors") be degradable. These devices are known to entangle birds, fish, marine mammals and turtles. Eleven states already require that beverage yokes be degradable, and the industry has been able to comply. Other plastic debris items that are known to pose a hazard for marine birds, mammals and sea turtles are plastic ropes, monofilament line, plastic bags, sheeting and film used for covering cargo, plastic strapping bands, and platic nets, webbing and traps used in commercial fishing operations. Any examination of the feasibility of requiring degradability should target on these high risk items, and examine the practicality of degradable applications.

At a symposium last month on degradable plastics, representatives of the industry reported that the technology exists to make all types of items degradable, it simply has not been applied yet to the specific products in question.

Several legislative proposals call for studies to identify and qualify the harmful effects of discarding plastics in the marine environment. We suggest that many of the effects of persistent marine debris are known, and that the time to study effects is long past. In some cases it is time to act. Should this committee consider asking federal agencies for studies and reports, we urge that the requested research be targeted and specific. Rather than do more general research, we must evaluate the state of information, determine what further information is needed—if any, and identify areas where enough is known to begin the job of reducing marine debris through existing federal programs and regulatory authority.

The above comments have focused on research or regulatory ideas that would target the item that becomes marine debris. The second path available for reducing debris is to control disposal. This approach focuses on the user/disposer. MARPOL Annex V would do just that by prohibiting ocean disposal of plastics, and by limiting disposal of other wastes to certain distances from land. The question then becomes, what do you do with shipboard waste if you can't dump it at sea?

Implementing the regulations of Annex V in the U.S. would prohibit or limit dumping by the merchant, passenger, fishing, and recreational vessels of the United States, and foreign vessels while in the U.S. Exclusive Economic Zone. The measure also requires that coastal states provide adequate garbage reception facilities in ports.

CEE has been asked by this Committee and others, "how is this actually going to work?" We have some recommendations, suggestions and ideas, which we will offer below. This question, though, can be most apropriately answered in detail in conjunction with the agencies charged with regulating and enforcing, with the affected industries, and with the private or quasi-public port authorities, harbor officials, and contractors who actually will provide the waste-handling facilities and services. This Committee will hear from these sectors of the marine industry, and we hope they will offer comment on the practicality of the following proposals and others made here today.

The basis for CEE's suggestions on an implementation regime for Annex V are founded on the premise that such a scheme must, at a minimum, provide (1) incentives to comply with the law, (2) procedures and facilities that make it reasonable and economically feasible to comply, (3) a method to ensure compliance and the resources to enforce it.

Dumping shipboard waste at sea has been a long-standing practice, not because of any bad intentions, but simply because it is easy. Changing this practice is going to require more than the stroke of a pen or the vote of an international organization. Our first choice for compliance incentives would be information and education, which we will discuss in more detail below. But education is a long-term process; in the short term, we must consider other options.

Certain penalties for failing to comply are one kind of incentive, or more accurately, a disincentive to ocean dumping. Another approach might be the use of mandatory fees which cover the cost of trash reception and disposal in port, but which would be paid whether the vessel used the facilities or not. This would be comparable to the pilot's fees charged by many coastal states, where the vessel must pay the pilotage fee, even if the pilot's services are not used: the theory being that if you are paying for it, you might as well use it. Such a fee would need to be high enough to avoid the temptation to continue dumping at sea because it is easy, and pay the fee as just another cost of doing business.

Another type of incentive could be to encourage vessels to get rid of trash by some method that not only avoids dumping, but avoids carrying it into port as well. Research and development grants, tax credits, or rebates to those companies whose vessels use on board incinerators, for example, might encourage development use of such technology.

The second element in making implementation of Annex V workable is to provide technically and economically feasible procedures and facilities. These procedures need to take into account the diversity of the vessel traffic at U.S. ports, and the capabilities of those ports.

It would be unreasonable, for example, to require a small harbor that serves principally fishing vessels of a size between 5 and 20 gross tons, and which don't stay out for more than a day, to provide the same level of reception facilities as a world class port that berths merchant vessels returning from voyages as long as two weeks.

Reception facilities at ports serving the coastwide, noncontiguous and intercoastal trade will have to differ from those ports serving oceangoing merchant vessels, because of U.S. Department of Agriculture requirements for the treatment and handling of foreign food wastes. Marinas that dock the thousands of recreational vessels in the U.S. pose yet another distinction. In other words, let us not mandate incinerators at every port, when in some cases a big trash barrel on the dock will do.

Based on what we know, we can make some suggestions on how to approach the problem; we do not purport to have all the answers. Those must be worked out with major contributions of knowledge and expertise from the industry.

First, we would recommend that waste disposal at marinas and harbors that cater principally to recreational boaters and fishing vessels under 5 gross tons be handled primarily by education and encouragement of voluntary compliance. Marinas should be required to post signs about trash receptacles and disposal requirements, similar to and in the vicinity of those posted for Annex I oil disposal requirements. The Coast Guard safety include information on proper trash disposal in boater safety courses. States should be encouraged to use informational posters or stickers at vessel registration points or include information in mailed vessel registration documents. All could be low cost methods of educating mariners about the prohibition against dumping. Perhaps an annual trash handling fee, based on the size and use of the vessel, could be assessed at the time of vessel registration with the state, or payment of moorage fees with the marina, to defray the costs of providing reception facilities and trash hauling.

For vessels of more than 1,000 gross tons, make presentation of shipboard trash a requirement upon entry into port, and require that ports serving this size vessel

provide adequate reception facilities. The size distinction would pick up merchant vessels of the U.S. ocean going trade, coastwise trade, non-contiguous trade, most of the intercoastal trade, passenger vessels, and a few commerical fishing vessels. There are 188 deep-draft seaports in the U.S. capable of handling vessels of this size. They are located along the Atlantic, Gulf, Pacific, and Great Lakes Coasts, and include ports in Alaska, Hawaii, Puerto Rico, and the Virgin Islands. These ports are likely to have facilities or access to reception and disposal facilities.

As to the actual receptacle, handling and disposal methods, we encourage the committee to seek the advice and expertise of those in the business. It is our understanding that equipment exists now that is capable of meeting the U.S.D.S. requirements for treating foreign food wastes, and that the costs are modest (approx. $.50/lb). As for the shipboard wastes from coastwise vessels, it seems the entire panoply of trash handling methods and devices would be available, and could be contracted for in the private sector by either the vessel operator or the port, as appropriate.

For purposes of educating seafarers as to the requirement for presentation, and enforcing the requirement, a written record of method of garbage disposal should be required. At minimum, such a record should include the signature of the ship's master or agent affirming that ship garbage was disposed in compliance with the convention. Entries, which could be included in an existing ship's log or separate "garbage logbook,"should include date and location of disposal of trash, method of disposal, and space to note it the vessel has incinerators and whether they are used to burn garbage, as well as space to comment on the adequacy of port facilities. Such a log should be available for inspection by the U.S. agency responsibile for enforcement.

In determining whether the trash offloaded indicates compliance with Annex V, the enforcement agency in charge, whether it be the port authorities, the Coast Guard, the U.S.D.A. or other enforcement agency, should use a reasonable standard.

It may not be necessary to compute average pounds of trash generated by seafarers on an average voyage and measure each offloading by that standard; such a process would be cumbersome. Based on the reasonable, subjective judgment of the official in charge, and considering such factors as availability of on-board incinerators, length of voyage, size of crew and so forth, it seems it would be possible to ascertain whether a ship had properly disposed of its trash.

U.S. vessels five tons or greater should be required to display galley notices pertaining to garbage dumping restrictions, telephone numbers for reporting violations, and description of penalties. Terminals servicing vessel 1000 tons or greater should be required (and other terminals encouraged) to post notices providing the same information. In addition, terminals should be required to provide readily accessible information about disposal facilities available, and about U.S.D.A. certified waste management companies which are authorized to handle foreign ship wastes.

Other possible actions that would aid in enforcement of Annex V are provisions allowing the payment of part of the assessed penalties to persons giving information leading to the assessment of such penalties. Provision for citizen suits against ship masters and owners for violating U.S. regulations is a measure we believe should be included in implementing legislation. Another consideration might be to broaden the enforcement responsibility to more than one agency, for example, including the Coast Guard, NOAA, EPA, Interior, and USDA, all of which have personnel in port and harbor areas.

The major concern about enforcement is the cost of carrying it out. Enforcement is always a costly proposition because it takes manpower. We do not propose that the Coast Guard or other agencies provide sufficient personnel to board every incoming vessel in every port in order to count their trash bags. We would encourage them to use the same investigative discretion they apply to enforcement of the provisions of Annex I, or in enforcing other laws of the United States.

However, recognizing that any additional enforcement effort is going to require additional money, we suggest a federal docking fee could be levied against vessels of 1000 tons or greater, and that the proceeds of this fee be dedicated to the agency responsibile for enforcing Annex V regulations. In Canadian ports, for example, where garbage removal from vessels is compulsory unless they have a government approved incinerator on board, the port authorities charge vessels alongside a berth a fee whether they use provided containers or not. The port then contracts with a waste handler to haul the trash to a disposal site.

Finally, I would like to address what we believe to be the most important point in getting control of the marine debris problem, and a point on which CEE is something of an expert: education.

CITIZEN AWARENESS AS A MEANS TO REDUCE PERSISTENT MARINE DEBRIS

CEE has long advocated that voluntary changes in behavior brought about by education and awareness of marine conservation issues is preferable to government mandating those changes. When it comes to the issue of persistent marine debris, we are not alone in that contention.

The Workshop on the Fate and Impact of Marine Debris, sponsored in 1984 by the National Marine Fisheries Service, is the event considered to be the starting point of the present major focus on persistent debris as an important marine pollution issue. Throughout the workshop, participants recommended educational efforts as the most effective first step in addressing the problem. Scientists and policy makers at that workshop proposed that information programs be developed to explain the problem to user and interest groups including the fishing industry, the plastic manufacturing industry, merchant carriers, the military, the general public, and appropriate international groups. They suggested that such efforts were not only a means of reducing the direct discard of material from ocean and land based sources, but also a way to instigate the development of techniques and behaviours to reuduce the impact of debris.

The Marine Entanglement Research Program, which we noted earlier is the only federal program directly targeted at this issue, has made education a major component of its program. Current efforts have been aimed principally at industry groups such as the commercial fishing, maritime and platics industries.

You have heard today from the Society for the Plastics Industry about their current advertising campaign, and the ongoing commitment to educate their own industry and others on this issue.

The National Marine Debris Roundtable, a panel of individuals with a national perspective on marine debris issues and solutions, acts as an advisory panel to the Entanglement Program. This group, too, has repeatedly recognized that not just attected industries, but the general public, would benefit from education efforts, particularly aimed at the need to handle and dispose of persistent materials (plastics) responsibly.

Last month, at the National Marine Pollution Program workshop on persistent marine debris, education as a way to mitigate the harmful effects of debris, was brought up repeatedly by workshop participants from a wide variety of perspectives.

We urge the Committee to encourage the federal agencies with authority and expertise in this area to concentrate the efforts of their public affairs and public information programs on the marine debris issue. National Parks, Refuges and Seashores, the Sea Grant Program, consumer affairs programs, boater education courses are all potential outlets for reaching million of Americans with the message "stow it, don't throw it."

Ms. LENTZ. Thank you, Mr. Chairman. I am Sally Lentz, staff attorney for the Oceanic Society. The Society is a 40,000 member nonprofit organization devoted to the protection, conservation and wise use of ocean and coastal resources. We recognize the problem of plastic pollution of the marine environment as an international one requiring international solutions. We are hopeful that Senate advice and consent for U.S. ratification of Annex V will be achieved in the near future.

Implementation of Annex V is expected to make a significant contribution to mitigation of the problem. Currently, as we have heard today, under U.S. law, ship-generated garbage goes largely unregulated beyond the three mile territorial sea. Annex V would require domestic implementing legislation providing more stringent controls on discharges of garbage and plastic.

I would like to focus my remarks this morning on some of the measures that might be taken to effectively implement Annex V. Specifically, I will address education, portside presentation of waste, enforcement jurisdiction and longer term solutions.

First, the most important tool we can employ for stopping the plague of plastic is education. Continued efforts to provide public information, education and training programs are a critical step in

eliminating marine debris. Such efforts should be targeted for various segments of the population, from merchant shippers to recreational beachgoers.

Second, it has been suggested that shoreside presentation of garbage be a requirement of entry into U.S. ports by commercial vessels that are not equipped with incinerators. The Oceanic Society supports presentation as an enforcement mechanism if that requirement is coupled with two other measures: shipboard waste management plans and garbage record logs.

We agree with those today who believe that each commercial ship should be required to develop a waste management plan to set out its strategy for compliance with Annex V. Plans will differ depending on ship size, crew size and onboard equipment. Each commercial ship could also be required to keep a log of its waste disposal practices similar to the oil record book required under Annex I.

Regarding plastics, a log entry could indicate offloading of the waste at a particular port or incineration on board the ship. The requirement for ships to keep a log would not create an onerous burden. It may be incorporated into an existing log.

Presentation of waste will be carried out in accordance with the ship's waste management plan. Presentation could be waived if, for example, a ship is equipped with a solid waste incinerator and evidence is presented by a log entry that the incinerator has been used in accordance with the ship's plan. Even ships not equipped with incinerators may warrant a waiver from presentation if a ship has recently offloaded waste at another port and has ample storage space to carry waste to the next port of call.

The enforcement measures we propose are made in recognition that the wide variety of ship designs, sizes and uses makes implementation of Annex V a special challenge. For this reason, it is appropriate to strive for a high degree of flexibility in our initial attempts to implement the annex.

Third, we believe that foreign flag vessels should be subject to U.S. enforcement jurisdiction within the exclusive economic zone. Strong legal bases exist for exercising this authority. The MARPOL Convention itself left open the possibility of coastal state enforcement jurisdiction in anticipation of such a provision in the Law of the Sea Convention.

Coastal state jurisdiction was provided for under that Convention, and legal scholars now suggest that because this provision has been accepted as customary international law, it may be applied to MARPOL.

The administration's proposed legislation would apply different enforcement measures to different vessels. U.S. flagships would be subject to enforcement wherever they might be. Foreign flagships of MARPOL contracting parties would be subject to enforcement within navigable waters of the U.S. Foreign flagships of noncontracting parties to MARPOL would be subject to enforcement within the EEZ. This approach gives preferential treatment to foreign flag vessels of MARPOL contracting parties over other foreign flagships and over U.S. vessels as well.

The Oceanic Society believes that if coastal state enforcement jurisdiction within the EEZ is to be applied, it should be applied uni-

formly to all foreign flagships. It is inappropriate, we believe, to selectively apply a customary international law principle.

The enforcement and implementation measures just described can be achieved in the shorter term. To facilitate more substantial long-term measures such as recycling efforts or use of degradable packaging, we recommend that implementing legislation include a provision for demonstration projects to facilitate cooperative efforts by all interested parties to solve the problem of marine debris.

In conclusion, it is clear that a major cooperative effort will be needed if we are to successfully cope with the problem of plastic and marine debris in the world's oceans. Although effective implementation will undoubtedly be difficult, the barriers to success are not insurmountable.

I submitted a more detailed statement for the record, and I thank you for the opportunity to testify today.

[The statement follows:]

Statement of Sally Ann Lentz
On Behalf of
The Oceanic Society

I am Sally Ann Lentz, Staff Attorney with the Oceanic Society. The Society is a 40,000 member non-profit organization devoted to the protection, conservation and wise management of marine and coastal resources. In all of our activities we are dedicated to protecting the oceans for the people and wildlife that depend upon them for life, livelihood and enjoyment. I appreciate the opportunity to testify on behalf of the Oceanic Society with regard to plastic pollution in the marine environment.

The Oceanic Society has long been concerned with the marine environmental consequences associated with uses of our oceans and coastal areas. During the decade and a half since its founding, we have conducted a wide range of scientific and technical research, education and public policy programs in our continuing effort to focus the attention of decision makers and resource managers on the need for information-based marine policies.

The oceans, though vast and covering over 70 percent of the earth, are a vulnerable and complex environment. Numerous unique and important species live in or depend upon the oceans. Too often, however, our ocean and coastal resources are mismanaged due to narrow, short range special interests, with inadequate scientific understanding of the consequences. We have seriously damaged some of our coastal waters, where marine life is more plentiful. Much less is known about long-term threats to the deeper oceans, but there are strong signs of damage there, too.

Policies affecting the future of the ocean and its resources must be developed with environmental consequences as a primary consideration. They must be set with appropriate respect for the linkages in the ecosystem. An ecological ethic is essential in order to ensure the protection, conservation and wise use of our vital marine resources. It is in this context that plastic pollution in the marine environment must be considered.

Problems caused by plastics and other persistent synthetic materials (including fishing nets) in the marine environment have resulted in growing public concern. Mounting evidence continues to demonstrate that large numbers of marine mammals,[1] birds,[2] turtles[3] and commercially important fisheries are lost as a result of entanglement in and ingestion of plastic materials. Lost and discarded fishing nets result in inadvertent destruction of living marine resources.[4] In addition, plastic bags, plastic spherules for packaging,[5] and plastic packing straps and rings contribute significantly to the problem.

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1. Fowler, C., "Entanglement as an explanation for the decline in northern fur seals of the Pribilof Islands," 25th Annual Meeting of the Standing Scientific Committee, North Pacific Fur Seal Commission (1982); Henderson, J. R., "A review of Hawaiian monk seal entanglements in marine debris," Workshop on the fate and impact of marine debris, 26-29 November (1984); Shaughnessy, P.D., "Entanglement of Cape fur seals with man-made objects," 11 Marine Pollution Bulletin 332-336 (1980).

2. Day, R.H. et. al., "Ingestion of plastic pollutants by marine birds," Workshop on the fate and impact of marine debris, 26-29 November (1984).

3. Balazs, G.H., "Impact of ocean debris on marine turtles: entanglement and ingestion." Workshop on the fate and impact of marine debris, 26-27 November (1984).

4. Degange, A.R. & Newby, T.C., "Mortality of seabirds and fish in a lost salmon driftnet," 11 Marine Pollution Bulletin 322-323 (1984); Eisenbud, R., The Pelagic Driftnet. FAO World Conference on Fisheries Management and Development, 27 June - 6 July (1984); Greenpeace, "Driftnets," Ocean Ecology Series, Fall (1985); Hammond, C., "Derelict gill net reported to National Marine Fisheries Service, Alaska Region in 1983," Workshop on the fate and impact of marine debris, 26-29 November (1984); High, W.L., "Some consequences of lost fishing gear," Workshop on the fate and impact of marine debris, 26-29 November (1984).

5. Carpenter, E.J. & Smith, J.L. Jr., "Polystyrene spherules in coastal waters," Science 178 749-750 (1972).

As reported by the Secretariat of the London Dumping Convention, the Workshop on the Fate and Impact of Marine Debris held from 27 to 29 November, 1984, in Honolulu, Hawaii concluded that "there is ample evidence that debris of both terrestrial and shipborne origin are widespread in the marine environment," and "substantial qualitative evidence indicates these interactions are contributing to increased mortality over that resulting from natural causes."[6] The workshop recommended that the problem be addressed through measures aimed at education, collection of information and mitigation.

The marine debris problem is attributed not only to dumping of municipal waste and ship-generated garbage, but also to the discharge of materials "via inland waterways and outfalls from plants that manufacture plastic."[7] These land-based sources are more appropriately regulated by domestic or regional agreements, whereas at-sea activities can and should be regulated internationally, and complemented by more stringent domestic laws.[8]

Recognizing the problem of plastic marine debris is an international one requiring international solutions, we note that the United States currently has an opportunity to play an instrumental role in influencing international regulation of the problem of plastics in the marine environment. United States ratification of Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL) would constitute an important step toward achieving that goal. Ratification and entry into force of Annex V would serve as a global "common denominator," while at the same time focusing attention on special concerns that merit stricter controls and other measures under supplemental U.S. law. The following discussion will therefore emphasize United States ratification and implementation of MARPOL Annex V.

MARPOL

The International Convention for the Prevention of Pollution from Ships (MARPOL) provides a legal mechanism for regulating five categories of ship-generated pollution through each of its five annexes, as follows: Annex I - oil; Annex II - chemicals carried in bulk; Annex III - hazardous substances in packaged form; Annex IV - sewage; and Annex V - garbage. [9]

The problem of plastics and marine debris is addressed in Annex V, which contains a provision prohibiting "the disposal into the sea of all plastics, including but not limited to synthetic ropes, synthetic fishing nets and plastic garbage bags."[10]

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6. "Environmental Hazards Caused by the Loss or Disposal at Sea of Fishing Nets and Other Marine Debris," Note by the Secretariat, LDC9/INF.4, 15 July 1985.

7. Wehle, D.H.S. and F.C. Coleman, "Plastics at Sea," 2 Natural History 20 (1983).

8. "Montreal Guidelines for the Protection of the Marine Environment Against Pollution from Land-based Sources," adopted by the Ad Hoc Working Group of Experts on the Protection of the Marine Environment against Pollution from Land-based Sources, the United Nations Environment Program (UNEP) Montreal, Canada. UNEP/WG.120/L.1/Add.2, April 18, 1985.

9. International Convention for the Prevention of Pollution from Ships, 1973, in "International Conference on Marine Pollution," 1973, International Maritime Organization, Publication 520 77.14E (1984).

10. Regulations 3 (1)(a) provides a prohibition on disposal of plastics outside "special areas" and Regulations 5 (2)(a)(1) provides for the same prohibition within, "special areas." "Special areas" for purposes of Annex V include the Mediterranean Sea area, the Baltic Sea area, the Black Sea area, the Red Sea area and the "Gulfs area."

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Only two of MARPOL's five annexes -- Annexes I and II, governing oil and chemicals in bulk, respectively -- have entered into force, having obtained ratification by states representing at least 50 percent of the world's shipping tonnage. Annex V of MARPOL has not yet entered into force. Including the Soviet Union's recent ratification, Annex V has obtained ratification by 28 states representing 48.2 percent of the world's shipping tonnage.

Once it enters into force, implementation of Annex V is expected to make a significant contribution to reducing the amount of plastics and other debris in the marine environment. Currently, under U.S. law, ship-generated garbage goes largely unregulated beyond the three-mile territorial sea. Ratification of Annex V would require domestic implementing legislation that would result in more stringent controls on discharges of garbage and plastics from ships than currently exist.

Specifically, U.S. ships will be prohibited from dumping plastics within or beyond the three-mile territorial sea. Practically, ships will have several options for satisfying this requirement of the Annex. Some vessels may choose to purchase supplies not packaged in plastic, or to eliminate the use of plastic disposable items (plates, cups, bags) so as to minimize the accumulation of plastics on board. Ships may segregate plastic garbage from other kinds of garbage for onshore disposal at reception facilities. The use of compactors or shredders will further minimize accumulation of plastic. Some ships may opt to install onboard garbage incinerators for disposing of their waste, but such incinerators should be carefully regulated to prevent pollution of the marine environment from stack emissions.

Under Annex V, dumping of other types of garbage will be restricted as well. Dumping of dunnage, lining and packing materials that float is prohibited within 25 nautical miles from the shore, and dumping of all other garbage is prohibited within 12 nautical miles from shore. It is likely that many if not most states will find it necessary to adopt more stringent domestic laws to comply with these provisions of Annex V.

The Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) oversees implementation of MARPOL and its annexes. The work of the MEPC focused initially on Annexes I and II relating to oil and chemicals carried in bulk. In recent years, the MEPC has turned its attention to the so-called "optional" annexes -- III, IV and V. A review of the optional annexes has taken place to determine if changes are needed in order to obtain the necessary ratifications for their entry into force. Priority has been given first to Annex III, second to Annex V and third to Annex IV.

At the 23rd Session of the MEPC, which met during the week of July 7 - 11, 1986, positive steps were taken toward entry into force of Annex V as the Committee completed its review of the Annex. It was decided that no amendments would be made to Annex V prior to its entry into force. However, it was also agreed that an amendment to Regulation 6 of the Annex be circulated in accordance with a "tacit amendment" procedure (Article 16 of MARPOL) after entry into force. This procedure provides for automatic amendment of the Annex unless, within a specified time, written objections are made by one-third of

the parties to the Convention or parties with combined merchant fleets representing at least 50 percent of the world's merchant fleet. Such a procedure allows for expedited amendment of the Annex.

The amendment to Regulation 6 of Annex V agreed to by MEPC was originally proposed by the United States and merely clarifies the existing provision. As currently stated, Regulation 6 provides several exceptions to the prohibition of discharges. One such exception is the "accidental loss of synthetic fishing nets or synthetic material incidental to the repair of such nets, provided that all reasonable precautions have been taken to prevent such loss." The United States suggested, and the Working Group agreed, that the phrase "incidental to the repair of such nets" be deleted from this exception. The rationale behind the clarification is that many of the fishing net pieces which are lost are discarded through repair, and such an exception would render the Annex ineffective. Regulation 6, as amended, would except only accidental loss of nets, and would remain applicable for nets intentionally discharged or negligently lost in the course of repair.

The Oceanic Society strongly supports ratification of MARPOL Annex V by the United States. U.S. ratification would contribute more than the 1.8 percent now needed for its entry into force, and will provide the necessary incentive for other states to ratify as well. Further, U.S. ratification of Annex V will serve as a message to the world community of our commitment to addressing this problem in a more effective manner. We are therefore hopeful that Senate advice and consent for U.S. ratification of Annex V will be achieved in the near future.

Domestic Implementation of Annex V

Other than a provision that states ensure that adequate reception facilities are available to receive wastes under Annex V, no specific measures to facilitate mitigation of the marine debris problem are offered in the Annex. Annex V leaves to vessel owners the choice of whether to refrain from bringing plastic packaging on board, to install onboard garbage incinerators or to utilize reception facilities for discharge of plastics on shore. At the 24th Session of the Marine Environment Protection Committee (MEPC 24; February 16-20 1987), a working group was convened to discuss effective means for implementing Annex V. During that working group session, the United States offered to draft guidelines for the next session of MEPC (MEPC 25; 30 November - 4 December 1987).

In treating Annex V as a global common denominator, states should view its provisions as providing minimum guidelines. Too often the minimum guidelines established internationally are treated in practice as the maximum standards to be applied. However, domestic legislation should go beyond the minimum guidelines of Annex V if marine pollution in a broader sense is to be most effectively addressed.

We recognize a concern expressed by the U.S. Coast Guard, that unilateral action by one state in the area of maritime matters may be frowned upon by some

some in the international community who value uniformity of standards and procedures over protection of the marine environment. We note however that the disapproval of the international community has not prevented the United States in the past from instituting more stringent requirements than those accepted internationally.[11] There are, however, enforcement and implementation measures that go beyond Annex V, which are not likely to be objectionable to the international shipping community. These and other measures for solving the problem of plastic pollution of the ocean comprise the focus of my remarks today.[12]

We recognize at the outset that the wide variety of ship designs, sizes and uses makes implementation of Annex V a special challenge. For this reason, we believe that it is appropriate to strive for a high degree of flexibility in our initial attempts to implement the Annex.

Before addressing specific measures for implementation of Annex V, we would like to address a more general issue. The Administration is proposing to implement Annex V through the Act to Prevent Pollution From Ships (APPS), 33 U.S.C. 1901 et seq. As the legal mechanism for implementing Annexes I and II, it is a logical choice for implementing Annex V as well. Implementation of Annex V by amendment of the APPS may be more expeditious than enacting new legislation, although such amendments should provide specific enforcement measures as discussed below. At the same time, all of the necessary provisions for implementation could be included in free-standing legislation such as H.R. 940. The Oceanic Society is more concerned about substance than form and we could support either free-standing legislation or implementation through the APPS.

Education

Perhaps the most important tool for solving the plastics problem in general and for effectively implementing Annex V, is education. Continued efforts to provide public information, education and training programs on the plastics pollution problem are a critical initial step in eliminating marine debris. Awareness of the serious nature of the problem encourages mitigation efforts.

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11. For example, under the Port and Tanker Safety Act of 1978, 33 U.S.C. Sec. 1221 et seq. (PTSA), all vessels in the 20,000 - 40,000 dwt category that are fifteen years or older after January 1, 1986 are required to be equipped with segregated ballast tanks or clean oil washing systems. These requirements go beyond internationally agreed upon standards. The PTSA further states that "[t]he Secretary ... may issue regulations that exceed standards agreed upon internationally." (Sec. 5(6)(A)).

12. The Oceanic Society recognizes the problems of entanglement resulting from pelagic driftnet fisheries. This method of fishing hinders effective fisheries management and causes widespread mortality of marine mammals and seabirds. The special nature of this problem requires legislative efforts separate from those relating to disposal of shipboard garbage and are not discussed in this testimony.

Special education and training programs should be targeted for various segments of the maritime community, such as merchant shippers, the fishing industry, and recreational boaters and beach-goers. One example is provided by those programs sponsored by the National Marine Fisheries Service Northwest and Alaska Fisheries Centers to educate members of the fishing industry in their region. Such programs must be continued and expanded among fisheries in the Atlantic, Gulf of Mexico, and Pacific Basin as well. Similar programs directed toward other segments should be implemented.

Professional associations can play a valuable role in education efforts, by publishing information about the problem and mitigation measures in professional journals and other association publications, or by sponsoring training sessions or seminars to address related issues of particular concern to its members.

Recognition and understanding of legal obligations under Annex V and domestic implementing legislation should be made a part of licensing requirements for seafarers (e.g. master's license for uninspected vessels), and should be a part of the curricula of the Coast Guard Auxiliary.

A notice of duties and obligations arising from Annex V, domestic implementing legislation and potential penalties for noncompliance should be posted on all inspected U.S. vessels in an appropriate location as a continual reminder to exercise diligence in properly disposing of ship-board waste.

Prohibited Acts

The Oceanic Society believes that the United States should enforce the prohibitions of Annex V of MARPOL to the fullest possible extent. The Administration's proposed legislation governs actions by persons on board U.S. flag vessels, within navigable waters of the United States for foreign vessels of MARPOL contracting parties, and within the U.S. 200-mile Exclusive Economic Zone (EEZ) for foreign vessels of non-contracting parties to MARPOL. In our view, the bill should reach further and be applied to any person subject to the jurisdiction of the United States. In this way, U.S. citizens would be bound by Annex V requirements, wherever they might be -- even on a foreign flag vessel within or outside of the EEZ. This is the standard jurisdictional reach of legislation of this kind; see, e.g., Section 102(a)(1) of the Marine Mammal Protection Act, 16 U.S.C. Sec. 1372(a)(1). MARPOL is designed to reflect a jurisdictional reach agreeable to all signatories and accordingly does not reach as far. However, where U.S. legislation can and customarily does reach farther, it should. This proposal would indirectly benefit the U.S. merchant marine by eliminating an incentive under the bill for U.S. flag vessels to switch to foreign registry.

Enforcement Jurisdiction

The Administration's proposed legislation suggests that Annex V enforcement jurisdiction will not be applied uniformly to all suspected offenders. As noted above, U.S. flag vessels will be subject to enforcement wherever they might be; foreign vessels of MARPOL contracting parties will be subject to enforcement within navigable waters of the United States; and foreign vessels

of non-contracting parties to MARPOL will be subject to enforcement within the EEZ. This approach gives preferential treatment to foreign vessels of MARPOL contracting parties over other foreign flag vessels and over U.S. vessels as well.

The Oceanic Society believes that if coastal state enforcement jurisdiction (within the EEZ) is to be applied, it should be applied uniformly to all foreign flag vessels. Coastal state enforcement jurisdiction is based upon a customary international law principle. It is especially inappropriate to selectively apply such a principle. We believe there is a strong legal basis and sound policy reasons for exercising enforcement authority over foreign flag ships within the EEZ.

In a paper presented at a UNEP conference in 1977, Mr. Sasamura, the former Director of the Marine Environment Division of the IMO describes what happened during the negotiations in 1973 leading to the adoption of MARPOL. Apparently, states having a large interest in protecting their coastlines attempted to extend the powers of the coastal or port states, whereas traditional maritime nations wanted to restrict that jurisdiction. A compromise was struck which was described as having three elements:

1) a flag state provision [flag states must establish sanctions under their law with respect to any violation of the Convention wherever it occurs];

2) a port state provision [States are empowered to inspect ships while in their ports and report suspected violations to the flag state]; and

3) a provision that any violation of the Convention within the jurisdiction of a coastal state is punishable either under the law of that coastal state or the flag state.

There was a divergence of opinion at the 1973 conference on the interpretation of the term "within the jurisdiction of a coastal state," i.e., whether powers of a coastal state could be exercised only within the state's territorial sea or if they could be extended beyond the territorial sea in line with the provisions being considered in the LOS negotiations that were taking place at the time. It was finally agreed to define jurisdiction "in light of international law in force at the time of application or interpretation" of the Convention (Article 9 (3)) and to reference coastal state jurisdiction without prejudice to what might be decided at a later conference.

Since that time, some legal experts have expressed the view that, under MARPOL, coastal states may extend jurisdiction in accordance with the LOS Convention.[13] Since the LOS Convention is generally accepted as customary

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13. It is important to note that under the LOS Convention the right of a coastal state to act with respect to violations occuring in the EEZ is restricted. Under paragraph 3 of Article 220, it is limited to the right to demand information of a vessel navigating in the teritorial sea or EEZ, when

international law, few states could argue that such jurisdiction is inappropriate. Indeed, U.S. enforcement authority in the EEZ predicated upon the LOS Convention is provided for in Presidential Proclamation No. 5030 of March 10, 1983, which established the U.S. EEZ. Proclamation 5030 states that the United States has jurisdiction with regard to "protection and preservation of the marine environment" within the EEZ. This assertion is consistent with statutes that have extended U.S. jurisdiction beyond territorial waters(e.g., Marine Protection Research and Sanctuaries Act, 33 U.S.C. Sec. 1411 et seq.; Outer Continental Shelf Lands Act Amendments of 1978, 43 U.S.C. Sec. 1814; and Magnuson Fishing Conservation and Management Act (16 U.S.C. 1801 et seq., (the "Magnuson Act")). Therefore, a strong legal basis exists for U.S. authority to enforce MARPOL against violations by foreign flag ships within the EEZ, under both domestic and international law.

Further, the exercise of coastal state jurisdiction within the EEZ is an appropriate policy choice because of the ineffectiveness of flag and port state jurisdiction.[14] It has been noted that "[h]istorically flag state enforcement has proved notoriously ineffective...."[15] Recognition of this fact lead to the "tripartite flag, coastal and port state enforcement regime embodied in the LOS

(Footnote 13 continued)
there are clear grounds for believing that while in the EEZ, the vessel has committed a violation of international rules or standards or of national rules conforming and giving effect to international standards. If a vessel refuses to supply requested information or provides information "manifestly at variance with the evident factual situation," or if the violation has resulted in a "substantial discharge" causing or threatening "significant pollution," paragraphs 5 and 6 of Article 220 authorize coastal states to physically inspect the vessel. The coastal state may arrest the vessel and take proceedings against it if the state has clear objective evidence that the violation resulted in discharge causing or threatening major damage to the coastline or related interests or to resources of the territorial sea or EEZ. The vessel must be permitted to proceed, under paragraph 7 if requirements for bonding or other security have been satisfied. Protection against abuse of coastal state enforcement jurisdiction is provided by the qualification that the violation involve the occurence or threat of significant pollution or major damage.

14. The Administration suggests that a greater than 95% compliance rate for Annex I indicates that flag state/port state enforcement jurisdiction is working effectively. There is an important distinction, however, between a compliance rate and effectiveness of enforcement measures once a violation is discovered. While most vessels are in full compliance with Annex I, it is not evident that enforcement mechanisms currently in place are adequately dealing with the offenders.

15. Bernhardt, J. Peter A., "Effective Enforcement in the EEZ Over Foreign Flags," paper presented at the Tenth Annual Seminar Sponsored by the Center for Oceans Law and Policy, University of Virginia, Southampton, Bermuda, March 12-15, 1986, p. 8.

Convention."[16] It has also been suggested that, in most cases, the United States does not exercise port state jurisdiction over foreign flags for pollution violations occurring in the territorial sea, contiguous zone and EEZ, but rather reports the incident to the flag state for enforcement.[17] Generally, flag states report back that no violations have occurred.[18] In addition, the United States currently exercises no coastal state jurisdiction for infractions by foreign flag vessels transiting the territorial sea or contiguous zone.[19]

One advantage to embracing coastal state jurisdiction at this time is that we can establish regulations that could serve as prototypes for eventual adoption by the international community.

On the other hand, failure to enforce Annex V as to foreign vessels outside territorial waters but within the EEZ would be highly discriminatory. U.S. flag vessels would be restricted within that area, while foreign vessels could pollute with impunity outside the territorial waters.

Based on the foregoing analysis, international and domestic law, as well as sound public policy, support U.S. authority to enforce MARPOL against violations by foreign flag ships within the U.S. EEZ. Whereas we support explicit inclusion of coastal state enforcement jurisdiction in implementing legislation for Annex V, resolution of this issue in the context of this legislation is not absolutely necessary. It may be more appropriately addressed in the broader context of how the United States views its marine pollution obligations and rights to enforcement. In that context, and to further assuage any potential misgivings regarding U.S. enforcement authority over foreign vessels in the EEZ, implementing legislation could provide for deference to flag states of offending vessels: as a matter of comity, the Coast Guard would refrain from enforcement so long as the flag state vigorously enforced MARPOL. However, it would reserve the right to act failing such enforcement.

Compliance of Public Vessels

The extent to which public vessels will or should comply with Annex V is an important issue that should be addressed in implementing legislation. Under Article 3 of MARPOL, public vessels are exempt from MARPOL requirements, although "each Party shall ensure by the adoption of appropriate measures not impairing the operations or operational capabilities of such ships owned or

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16. Id.

17. Id.

18. Id.

19. The United States does, however, under the Intervention Convention and Intervention on the High Seas Act, take action beyond the territorial sea to prevent a maritime casualty, including pollution or threat of pollution resulting from the casualty. Such intervention reaches farther than enforcement measures under the customary law of the LOS Convention.

operated by it, that such ships act in a manner consistent, so far as is reasonable and practicable, with the present Convention." We believe that all public vessels can and should comply with the requirements of Annex V and we therefore recommend that implementing legislation require full compliance. Such compliance may be more readily achieved on new vessels which have taken such requirements into account in construction and design. However, changes in equipment or ship-board practices should allow existing vessels to substantially comply with these provisions. There may be some allowable exception for warships operating during times of war, when compliance with such requirements might jeopardize national security.

Reception Facilities

Under Annex V, state parties are required to ensure the availability of adequate reception facilities. This is the only specific implementing measure contained in the Annex. With regard to Annexes I and II, the United States has not interpreted this requirement to mean that the government itself must provide reception facilities. Instead, market forces have been relied upon to fill the need. This approach has appeared to work in the United States with respect to Annex I. However, Annex II has only recently come into force, so it is hard to assess the success there.

The APPS currently provides for the development of regulations that set out criteria for reception facilities, and allow ports and terminals to apply for a certificate of adequacy for such facilities. We believe that in the first instance, this is a good approach. If it appears at a later date that the demand for reception facilities of this kind has not been met by the open market, then it will be appropriate to consider requiring government involvement in providing this service.

We therefore recommend that a provision be made for establishing criteria for adequate reception facilities. Suggested language might track the language of 33 U.S.C. Section 1905 with regard to port reception facilities for oil or noxious liquid substances, which allows ports to apply for certificates of adequacy for reception facilities.

The Administration's proposed legislation would require selected ports to provide reception facilities. We believe this requirement does not afford the degree of flexibility needed to address the wide variety of ports and terminals that currently exist and the differing resources available to them. In some instances, it may not be appropriate or economically feasible for the port itself to finance a reception facility. It may be advantageous instead for the shippers or private waste disposal companies to take primary responsibility for providing the necessary facilities. We believe our suggested approach would provide the necessary flexibility to achieve the goal without over-burdening our ports.

Vessel Waste Management Plan

We recommend that compliance with Annex V be accomplished, in part, by requiring commercial ships to develop and implement individual "Waste Management Plans" to be approved by the Coast Guard. Each plan would set out that ship's strategy for compliance with Annex V. Strategies will differ depending on size of the vessel, the nature of its cargo, crew size, equipment (e.g., incinerator, compactor) and trade route. Such a plan will ensure careful consideration of available options for compliance with Annex V and, in conjunction with record book and presentation requirements (discussed below), will facilitate effective enforcement.

Garbage Record Book

We recommend that compliance with Annex V be demonstrated by requiring commercial ships to keep a log book of their Annex V waste disposal practices. Under Regulation 20 of Annex I, ships are required to keep an oil record book as part of the ship's official log book or separately, to record, among other things, loading and unloading of oil cargo, ballasting and cleaning of cargo tanks, and discharge of ballast and bilge water. Each operation to be recorded must be signed in the log book by the officer in charge of that activity and countersigned by the Master of the ship. In practice, this responsibility is taken quite seriously. The oil record book is required to be readily available for inspection and copying by the government representative of a MARPOL contracting party.

A similar "Garbage Record Book" could be required for Annex V. With regard to plastic, an entry in the log could indicate that the waste was off-loaded at a particular port, or incinerated on board the ship. Compliance with other requirements of Annex V could also be recorded. For example, since Annex V allows the discharge of certain garbage beyond 25 miles of the shoreline, the date, time, location and approximate amount of garbage discharged could be easily entered in a log book. A requirement for ships to carry and utilize such a log book would not create an undue economic burden. Indeed, it may not be necessary to create a separate log for this purpose. As with Annex I, such entries might be incorporated in an existing log.

Presentation

It has been suggested that shoreside presentation of garbage be a requirement of entry into U.S. ports by commercial vessels that are not equipped with incinerators. The Oceanic Society supports a presentation requirement, if such requirement is carried out in conjunction with consideration of an individual ship's solid waste disposal plan and compliance with that plan through appropriate entries in the ship's waste disposal log. Presentation of waste may be waived if a ship is equipped with a solid waste incinerator and evidence is presented (by a log entry) that the incinerator has been used in accordance with the ship's plan. Ships that are not equipped with incinerators may, under some circumstances, warrant a waiver from presentation. For example, if the ship has recently off-loaded waste at another port and has ample storage space to retain waste to be off-loaded at a subsequent port, it may not be necessary

to require off-loading of waste at the current port of call. Such a waiver should, however, be issued only where evidence of compliance with the ship's waste disposal plan is provided (e.g., through an appropriate log entry).

Regulations implementing a presentation requirement, as well as requirements for solid waste disposal plans and logs, should be designed to prevent undue discrimination against U.S. flag vessels. While it will be difficult for the U.S. government to require foreign flag ships to carry an approved waste disposal plan, it would be possible to require entries in the foreign ship's log of most recent disposal activity prior to entering a U.S. port, and all disposal activities while present in the U.S. EEZ.

Since enforcement authorities of the Department of Agriculture and the Coast Guard are already present at ports, a new administrative bureaucracy would not be required to implement requirements for a garbage record book or presentation.

Floating Materials

Annex V allows floating dunnage and floating non-plastic packing and lining materials to be discharged beyond 25-miles from shore. Because a majority of this cargo-associated waste is generated during loading and unloading, we believe such waste should be required to be off-loaded at appropriate reception facilities, rather than be permitted to be carried offshore for discharge into the sea. The limited amount of such waste that is generated at sea could be stored along with any plastic waste for onshore disposal or managed similarly to plastic waste. Such a practice could easily be instituted without undue burden on shippers. Floatables represent a special problem in that they are more likely to be carried ashore than other waste that sinks. As such, they make a special contribution to destruction of coastal amenities. The benefits to coastal communities are far outweighed by the minor burden of properly disposing of such materials.

Use of Ship-Board Incinerators

The high cost of ship-board incinerators, coupled with their size and labor-intensive nature has greatly limited their use to large merchant ships. Although incineration of ship-board garbage may be one alternative to dumping waste into the sea, it poses a different set of environmental concerns. The EPA has recently determined that land-based municipal waste incinerators "may reasonably be anticipated to endanger public health or welfare..." and has announced its intent to regulate certain pollutants from municipal waste incinerator emissions under the Clean Air Act.[20] Municipal solid waste incinerators typically release heavy metals, dioxins and acid emissions. Metals and dioxins may be released in air emissions or fly ash. The amount of dioxins released will depend in large part on the combustion efficiency of the incinerator. Since most solid waste incinerators can not achieve the 99.9%

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20. "Assessment of Municipal Waste Combustor Emissions under the Clean Air Act," 52 Fed. Reg., July 7, 1987, at 25407.

combustion efficiency necessary to destroy dioxins, measures must be taken to ensure the safety of the marine environment by reducing post combustion formation of dioxins and using the proper disposal techniques of residues remaining from the burning process.[21]

Most marine garbage incinerators are less preferable from an environmental perspective than their land-based counterparts because ocean-based models are not required to be equipped with air pollution control devices to comply with Clean Air Act emission standards. Emissions from ocean-based solid waste incinerators are currently unregulated. The Oceanic Society strongly recommends that, in light of potential greater reliance by the shipping industry on the use of ship-board incinerators for garbage disposal, that such incinerators be regulated to ensure environmental protection. Specifically, ocean-based incinerators should be required to achieve the same emission standards as land-based incinerators. In addition, stringent regulations should be promulgated to restrict disposal of hazardous materials in such incinerators and to require land-based testing and proper disposal of ash residues arising from their use. Residues and ash from solid waste incinerators that contain dioxins and heavy metals are toxic and may require disposal in licensed hazardous waste incinerators. The EPA is just beginning to develop standards for municipal incinerators on land. We recommend that the EPA also be authorized to regulate similar ship-board incinerators and be directed to develop appropriate standards for their control.

Demonstration Projects

The enforcement and implementation provisions listed above can be achieved in the short term. More substantial efforts require longer start-up time and more careful planning. To facilitate the development of such efforts we recommend that implementing legislation include a provision for the development and conduct of demonstration projects. Federal funding could be provided as an incentive for the shipping industry, the plastics industry, national, state and local governments, and environmental and citizen groups to engage in cooperative efforts to find solutions to the problem of marine debris from ships.

Examples of such projects might be: (1) a waste recycling project that would demonstrate the feasibility of at-sea separation of waste (e.g., glass, plastic, metal) for receipt at specially designed port facilities for recycling;[22] (2) a degradable plastics project to demonstrate the feasibility of using photodegradable plastic and biodegradable plastic as packaging for ships stores; (3) a renewable resource project to demonstrate the feasibility of

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21. See. Environmental Defense Fund/Environmental Information Exchange Fact Sheets entitled, "Introduction to Incineration," "Municipal Incinerators," "Incineration and Metals," and "Ash from Municipal Solid Waste Incinerators," EDF, 1616 P Street, N.W., Washington, D.C. 20036.

22. The March 1987 issue of Modern Plastics suggests a great potential for waste heat recovery from recycling of plastics.

using products packaged in paper, fiber or related products for ships stores; (4) a project to demonstrate the feasibility of minimizing the generation of ship-board garbage (particularly non-degradables) through recycled packaging, use of degradables or bulk packaging; (5) a project to demonstrate port loading and unloading practices to minimize the loss of dunnage and cargo residue; (6) a project to develop new ship construction design to facilitate compliance with Annex V; and (7) a project to develop new ship-board incinerator design or other innovative thermal destruction technology to eliminate toxic emissions.

At the very least, an assessment of these complementary solutions to the problem should be required.

Penalties

We recommend that implementing legislation include both criminal and civil penalties, as are currently provided for violations of Annexes I and II of MARPOL. In addition, we suggest that the amount of the civil penalty be changed to a minimum penalty of $25,000 for each violation. The establishment of a minimum penalty suggests the importance of compliance with the stated prohibitions and would be appropriate if coupled with Secretarial discretion to compromise, modify or remit penalties. Such discretion would allow the Secretary to alter the penalty where appropriate (e.g., recreational boaters for whom a $25,000 penalty might be inappropriate).

Data on penalties imposed by the U.S. government for infringements of Annex I in 1985[23] suggest that a minimum penalty may be necessary to ensure that penalties are sufficiently high so as not to be considered an acceptable cost of doing business. The penalties imposed during that time ranged from $500 to $2,000. Without more specific information on the nature of the violations it is difficult to assess the reasonableness of these penalties. Nevertheless, a substantial minimum penalty would contribute greatly to the seriousness with which these obligations are viewed.

In addition, we recommend that domestic legislation specifically hold ship owners and captains responsible for civil penalties imposed for violations of Annex V committed in relation to operation of their vessel.

Further, we strongly recommend the inclusion of a citizen suit provision in implementing legislation that would allow suits by private citizens to protect the public interest in compliance with Annex V.

Use of Degradables

The Oceanic Society believes that efforts should be made to explore the feasibility of substituting non-plastic materials for plastic products that have been associated with adverse impacts on marine fish and wildlife, such as fishing gear, six-pack yokes, strapping bands, sheeting, plastic bags, and

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23. United States Coast Guard, Summary Report By the United States to IMO of Alleged Violations of the Discharge Provisions of MARPOL 73/78 Referred to Flag States," MEPC 24/14/4, December 22, 1986.

other products which bio- and/or photodegrade rapidly when released into the freshwater and marine ecosystems. This might be accomplished through the demonstration projects proposed above.

Land-Based Sources of Plastic Pollution

The Oceanic Society believes that the discharge of land-based plastics into the marine ecosystem is excessive. Some of this may be from landfills, but much is likely coming from releases to surface waters through sewage treatment works or as a consequence of bypassing these works. The EPA should be required to prepare a report on this matter, with a view toward legislation to address the special nature of this problem, including an analysis of possible sources as the improper design or operation of publicly owned treatment works, the bypassing of such treatment works, and releases to surface waters from industrial wastewater treatment facilities, storm drains, landfills, and non-point sources. The study should contain recommendations, which may include additional legislation, the redesign of treatment works, screens or other devices to prevent floating materials from reaching surface waters through storm drains, stricter enforcement, and such other measures as the Administrator believes desirable and feasible.

Appropriations

Due to the magnitude, degree, and extent of the plastic debris problem, and the need for strong and effective enforcement measures, the Oceanic Society believes that generous appropriations to tackle the many facets of this problem should be provided. We recommend an increase in the authorized appropriation level of $2 million per year and an extension through FY 1990.

As we noted at the outset, the effectiveness of the legislation will be directly dependent upon the strength of implementing and enforcement mechanisms. A substantial amount of this appropriation should be earmarked specifically for enforcement efforts by the Coast Guard, National Marine Fisheries Service, and the Department of Agriculture, as appropriate.

Conclusion

It is clear that a major cooperative effort will be needed if we are to successfully cope with the problem of plastics and marine debris in the world's oceans. Although effective implementation and enforcement of protective measures will undoubtedly be difficult, the barriers to success are not insurmountable.

The United States has played a leading role in encouraging strong international regulation of vessel-source pollution. The Oceanic Society is hopeful that U.S. efforts to address the problem of plastic pollution in the marine environment will continue to reflect this leadership role.

Through international cooperation, strong domestic initiatives, public education and continued scientific efforts to better understand the problem, our collective responsibility to protect our precious ocean and coastal resources can be met.

Many of the views expressed in this testimony have been endorsed by members of the Entanglement Network, a consortium of environmental, conservation and animal protection groups concerned about the problem of plastic and marine debris.

In closing, the Oceanic Society appreciates the National Ocean Policy Study's concern about this important issue. We look forward to assisting you and other Members in both the House and Senate in bringing into effect -- as expeditiously as possible -- both environmentally sound domestic legislation and U.S. ratification of Annex V.

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Senator BREAUX. Thank you very much. All of you have given very good statements. Ms. Lentz has done a lot of work on the legal aspects of it, which will be helpful for us in our consideration of the bill.

I am pleased that Senator Stevens has stopped by. He indicated he will be working with us on the legislation that the administration is sending over, and we are joined by our good friend and colleague from Texas, who would be very proud of Mr. Mauro's statement, which is very good. Senator Bentsen originally, I think, called for these hearings, and for that we are very, very pleased that he is able to be here.

Senator Bentsen, do you have any comments?

OPENING STATEMENT BY SENATOR BENTSEN

Senator BENTSEN. How much time do you have, Mr. Chairman?

I feel very strongly about the issue, and I am just delighted to have Commissioner Gary Mauro, who is not only a personal friend but a fine public servant who has been a tireless advocate of cleaning up our beaches. One who has walked those beaches and seen the kind of litter that is thrown up on the beaches understands what it does to our environment and what it does for health purposes and what it does to commercial ventures along that coast.

I am very hopeful that we can bring to pass the idea that we can get the Gulf of Mexico set aside as a special area and stop the dumping of solid waste in that area. I have seen the marvelous things that have been done for the Chesapeake, and I think, in turn, the Gulf of Mexico deserves that kind of attention.

I am most appreciative, Mr. Chairman, that you have held these hearings that I had requested and that we heighten the interest in this particular endeavor. This is one of the few issues I have seen where there is just unanimous concern about what is happening to our beaches and, in turn, joining together to try to see a solution to it.

I am just delighted at the hearings and the quality of witnesses that you have brought forth, and although I was precluded from being here to hear your testimony, Commissioner, they tell me you came on real strong. You done good, and I am delighted and proud of your effort.

Mr. MAURO. Thank you, Senator.

Senator BENTSEN. Mr. Chairman, this is an important hearing on an important subject. Our oceans are being polluted with plastic, garbage, and solid wastes. Far too much floats ashore and litters our beaches.

In Texas there has been a strong and positive response to this problem through the "Adopt a Beach" and "Don't Mess with Texas Beaches" programs. Volunteers have picked up tons of debris, but their valiant efforts alone can't turn back the tide.

This is one of those are occasions when there is widespread recognition of a problem and a widely supported solution ready at hand. The Senate has before it Annex V of the marine pollution convention, which would set tough international standards against the dumping of plastics, garbage, and solid wastes. The treaty also

has a provision allowing the designation of additional "special areas" where no solid waste dumping would be allowed.

I am especially pleased that the U.S. delegation to the International Maritime Organization has already begun the process to have the Gulf of Mexico designated as a special area under the terms of the convention. I am also pleased that the Coast Guard and NOAA have agreed to my request that they cooperate with the Center for Environmental Education to develop the scientific evidence needed to persuade other nations to make the Gulf of Mexico a special area.

Such action would help greatly to reduce the pollution in the Gulf and the litter which washes onto our shores. The environment, recreation, and commerce, are threatened by the ocean dumping which this agreement would prohibit.

I understand that the Foreign Relations Committee has a hearing on this agreement scheduled for this Friday, so the full Senate may be able to give its advice and consent after the August recess. Then we proceed with the necessary implementing legislation through this Committee.

Mr. Chairman, I am grateful that this Committee has agreed to my suggestions that we have this hearing, especially that we have as a witness the Texas Land Commissioner, Garry Mauro, who has been a tireless advocate of measures to give us cleaner oceans and beaches.

Senator BREAUX. Let me thank Senator Bentsen for his leadership in this area.

Dr. Liffmann or Mr. Mauro, what about the oil rigs that you have in the Gulf, the thousands of platforms and operations out there? How do we regulate their disposal of solid waste?

Mr. Mauro?

Mr. MAURO. Mr. Chairman, there are two types of oil rigs, of course. There are those on state waters, and there are those in the Outer Continental Shelf regulated by MMS at the Department of the Interior.

What we do in Texas state waters is require a solid waste management program to be put in place by every single rig. In other words, we require that solid waste taken out to a platform be returned to shore and that they have a plan in place to show that. We inspect those platforms routinely to see that their solid waste plans are, in fact, being implemented.

Every platform has a little bit different program. The key, of course, is inspection to make sure that what is in place is actually being implemented.

Now, I cannot speak for the Minerals Management Service, but we work very closely with those people. They do a pretty good job of monitoring what goes on the platforms. They, too, have a strong solid waste management requirement, and I think they inspect it reasonably well.

Mr. Chairman, I do not think you can overemphasize how cooperative the industry in general wants to be. They use the beaches, and they do not want to be blamed for fouling the beaches. They have a strong education program in place, and I think we have stopped the institutional dumping from our oil and gas platforms.

We have not stopped occasional littering from our platforms. Of course, that is the next step.

Senator BREAUX. Dr. Liffmann, tell us something about Louisiana.

Dr. LIFFMANN. The situation is quite similar for us, Senator. As you well know, we have over 3,000 platforms offshore. In its heyday, the industry employed some 30,000 persons offshore and about 800 or so vessels serviced these platforms.

The MMS has been working with this industry since 1977, and they have developed exellent waste management plans. Unfortunately, at the state level we do not do a good job of enforcing antilittering and no-dumping laws into our inshore waters.

Senator BREAUX. I take it Annex V does not really deal with stationary fixed platforms, does it?

Dr. LIFFMANN. I believe it does.

Ms. LENTZ. Yes, Mr. Chairman, it does.

Senator BREAUX. It does? In other words, anything in the water, whether it is stationary or a moveable vessel, would be regulated?

Ms. LENTZ. It does apply to oil platforms that are stationary.

Senator BREAUX. It specifically does.

We had testimony from the Navy which I assume that you all heard which indicated that they really cannot comply with Annex V with regard to plastics at this time. Of course, their vessels are huge, running up to 4,000 and 5,000 on each vessel.

What are your thoughts about their not being covered by Annex V?

Mr. McManus?

Mr. MCMANUS. Mr. Chairman, in our written testimony we suggested that, in legislation for implementing the treaty, there be a special report required on public vessels.

In our discussions with the service, we have felt that more could possibly be done. Unfortunately, what we have run into is no, it cannot be done and that is that. Clearly, as I indicated to you earlier, something has to be done. If, for example, the Navy starts regularly disposing of trash in the Gulf of Mexico, we are going to regularly see it on the beaches.

I did some quick calculations based on previous testimony by Mr. Koss, and if his figures are accurate and my quick calculations are accurate, we are talking about 15 tons per day of Navy plastics going into the ocean.

Now, there is a big difference between a ship making a long transit voyage somewhere and a ship going out of harbor to test some equipment or going on a training voyage. I think the service needs to be a little bit more forthright about how they can do a better job and look at it from a more positive constructive approach.

Senator BREAUX. Mr. Mauro?

Mr. MAURO. Mr. Chairman, I am just the Texas land commissioner, but I did try to see the admiral in charge of logistics to talk about this. His executive assistant sent me to see the captain who is Mr. Koss' boss. The captain made an appointment to see me to discuss it and did not show up. I got to speak with Mr. Koss again.

I then asked to see the Secretary of the Navy, who sent me to an administrative assistant who did show up and who told me that the

Navy was going to come up with a comprehensive plan to deal with Annex V. His office has contacted our office several times since then and, working with Senator Bentsen's office, we think they are going to come up with a better plan than Mr. Koss lists for us.

I get the impression, Senator, from my perspective down in Austin, that nobody in a decisionmaking capacity is really looking at Annex V, but I am sure that you will be able to solve that problem.

Senator BREAUX. I guess the other question is, assuming we move forward quickly with legislation implementing Annex V, how much of a solution to our problem will Annex V be? I get the impression that we would make some major strides by adopting Annex V.

Dr. Liffmann?

Dr. LIFFMANN. Sir, we can make major strides by adopting Annex V, but the problem is fundamentally one of public education. We need to instill an awareness——

Senator BENTSEN. Excuse me. I did not understand that.

Dr. LIFFMANN. The problem is one of public education, Senator. We need to instill an awareness in all of the concerned parties, the offshore industry, the maritime industry and our own residents, in the problems associated with plastics disposal and plastics pollution.

Annex V will by and large take care of the policy problems. There still remains the matter of education. Our Sea Grant Program throughout the county are very interested in addressing this issue and have in fact begun to do so. Our 30 member institutions have met, and a National Steering Committee has been set up where the marine advisory service people, directors as well as communicators will be working together on this topic.

Senator BREAUX. Mr. McManus, did you have a comment?

Mr. MCMANUS. Yes, Mr. Chairman, just to follow up on that for a moment. We should keep in mind that the Annex V initiative is just going to cover the dumping at sea and does not address some of the many other important elements that have been discussed including the possibility of requiring certain plastic articles to be degradable, the potential for looking into other things being made degradable, and also for controlling land-based sources and other elements of this problem.

So I think it is very important in reviewing the administration's bill that the very useful initiatives made in other legislation be considered for the final approach to the problem, because it is more widespread than just simply regulating disposal from vessels.

Senator BREAUX. How much of a problem with regard to the fishing impact is monofilament and plastic nets, et cetera, breaking loose?

Mr. MCMANUS. Well, it appears to be a problem. As was noted before in the previous panel, it is hard to quantify, but it does seem to be a major problem, and there are figures that we could provide the committee with respect to, for example, projections of lost fish traps. Every time a lobster pot is lost or a crab pot is lost, it continues to fish, and so the resource is certainly impacted by that, assuming that those devices are effective catchers of the prey they are after.

One of the things that we have suggested, for example, to help solve that problem is to make sure that the traps have biodegradable fasteners; not make the traps biodegradable but have fasteners on the panels that are biodegradable and would be routinely replaced with maintenance. If a trap was lost, therefore, within a matter of time the trap would fall apart or an opening would be revealed so that it would not continue to catch and waste the resource.

So this does need to be looked at, and certainly we are well aware of the immense problems made with drift nets and other inherently wasteful fishery practices.

Senator BREAUX. Mr. Mauro?

Mr. MAURO. Mr. Chairman, the thing that Annex V does, in my opinion, is it stops the institutional dumping of garbage. We do not have a litter problem. We are not talking about somebody throwing a beer can off an oil and gas platform. What we are talking about is ship generated garbage and the only way it is currently being eliminated from the ship or the platform is to be thrown overboard.

What Annex V does is eliminate that institutional dumping. It is kind of like stopping the open sewers from running into our rivers. Hopefully you can come back and fine tune it after we stop the institutional dumping of garbage.

Senator BREAUX. Senator Bentsen, those bottles on the table that Mr. Mauro presented he described them as being not from Texas. Where were they from, Mr. Mauro?

Mr. MAURO. Well, we have a detergent bottle from Singapore, toothpaste from Italy, shampoo from Venezuela, and bitter lemon from Great Britain. Obviously we Texans did not leave these on our beaches on the weekend.

Senator BENTSEN. It is obvious they have full access to our markets and our beaches.

Senator BREAUX. Well, we want to thank this panel very much if Senator Bentsen has no additional questions. I think you all have made the case very strongly and eloquently, and I thank you very much for your participation. The panel will be excused.

Senator BENTSEN. If I might just for a minute, Mr. Chairman, ask a couple of questions here.

Senator BREAUX. Certainly.

Senator BENTSEN. I noted in the report attached to your testimony that the 1985 Texas Coastal and Marine Council reports that 75 to 90 percent of the trash comes from offshore sources.

Do you agree with that? Apparently you do.

Mr. MAURO. Yes, sir. It has changed a little bit, Senator, in the last year. Since the 1985 report, we have put out a report from our last September 20 effort with the Center for Environmental Education. Also from our April effort, it appears that the oil and gas regulations we put in place have diminished the garbage from that source.

At least, we would like to think our regulations have diminished some of the trash coming from our oil and gas platforms. It might be from decreased activity. We cannot tell yet. I think 15 percent would be a high figure for what we are finding on our beaches which is actually litter. The other 85 percent, even 90 percent, is

coming from offshore sources, and I think there is no doubt about it. That is why I brought these bottles.

When I went down for the coastwide cleanup, Senator, I thought I was dealing with a litter problem where we were going to be picking up Lone Star beer cans. I did not know I was going to be picking up Italian toothpaste containers.

Senator BENTSEN. I suppose you spoke to the point of what has been happening. Mr. McManus was talking about education and publication and the idea of informing the public.

You have spoken to the point about the adoption of beaches, "Don't Mess With Texas Beaches" and that particular program. It is interesting how they have pitched that. They have gone to great lengths to aim that at those persons that normally would be the ones that throw the beer cans and throw some of that particular kind of garbage.

It is interesting, too, to see that we have done it not just for our beaches but we are doing it for our highways. The planting of wildflowers along the highways has cut our litter cost down substantially. People do not like to throw a beer can into a bunch of flowers.

We have actually saved money in the process, and we have put that into the Federal legislation now that wherever it is feasible that you have the planting of those wildflowers. We are extending some of Lady Bird Johnson's beautification program. I would like to see what we can do to really implement the cleaning up of the beaches.

Let me ask you. If we designate the Gulf of Mexico as a special area, how much do you think the amount of trash would be decreased?

Mr. MAURO. We estimate at least 40 percent of what we are picking up on the beaches today.

Now, Senator, the Gulf, of course, is a closed basin. It only recirculates every 87 years, so we will still spend a good part of our time cleaning up what is floating around in the Gulf right now, but with our "Adopt A Beach" program and with our "Don't Mess With Texas Beaches" program, we think over a 10-year period we could clean out what is presently in the Gulf, and if the sources were stopped it would diminish significantly in a very short period.

Senator BENTSEN. Thank you very much, Mr. Chairman.

Senator BREAUX. Thank you, Senator, and I thank this panel very much for their helpful testimony.

I would like to welcome our final panel, which will consist of Mr. Joseph Cox, the Director of Marine Affairs for American Institute of Merchant Shipping; Dr. William Brown, Director of Government Affairs for Waste Management, Incorporated; Mr. Louis Freeman, Vice President of Government Affairs for the Society of Plastics Industry; and Mr. Erik Stromberg, who is President of the American Association of Port Authorities.

Gentlemen, if you would take your seats at the witness table, we would be pleased to receive your testimony.

STATEMENTS OF JOSEPH J. COX, DIRECTOR, MARINE AFFAIRS, AMERICAN INSTITUTE OF MERCHANT SHIPPING; DR. WILLIAM Y. BROWN, DIRECTOR, GOVERNMENT AFFAIRS, WASTE MANAGEMENT, INC.; LEWIS R. FREEMAN, JR., VICE PRESIDENT, GOVERNMENT AFFAIRS, SOCIETY OF THE PLASTICS INDUSTRY; AND ERIK STROMBERG, PRESIDENT, AMERICAN ASSOCIATION OF PORT AUTHORITIES

Mr. Cox. Thank you, Mr. Chairman.

My name is Joe Cox with the American Institute of Merchant Shipping. Our President, Ernie Corrado, extends his regrets for being unable to attend. He had a prior commitment of long standing on the West Coast.

AIMS represents the major portion of this country's bulk fleet and a sizable portion of our oceangoing liner fleet. Mr. Chairman, I would like to point out that our comments and our statement for the record are also supported by the Council of American Flag Ship Operators [CCASO]; the Joint Maritime Congress [JMC] and the Maritime Institute for Research and Industrial Development [MIRAID].

Mr. Chairman, I would just like to summarize my testimony. As a general comment, we ship owners feel that oceangoing ships certainly generate refuse which ends up in the waters and in this nation's waters. We recognize that we contributed to the problem and we are ready to clean up that portion that we contribute.

However, we believe that there are many polluters who contribute to this problem and we would certainly suggest that all major contributors have to take a part in that cleanup effort.

In commenting on specific legislation, we support ratification of Annex V. We feel that the part of the problem that is caused by ships is one of an international nature and it should have an international solution, and we feel that that solution at present is Annex V to the MARPOL Convention.

U.S. law and regulation implementing Annex V is the proper solution. We believe that the Act to Prevent Pollution From Ships is the proper mechanism for incorporating the proper procedures and addressing the Annex V problem.

Annex I and II are presently already implemented in that same manner, and we feel it is the proper place for Annex V implementation of regulations by the Coast Guard.

Mr. Chairman, turning to enforcement questions, and I have got to point out that enforcement is certainly, in our estimation, the key problem that has to be overcome. In solving the problem of the nation's, this particular nation's beach problem and, I would point out, the world's problem of plastics in the ocean, first of all, we think that any enforcement has to cover all polluters.

And for us, the first step in terms of ocean going merchant vessels is an education and training program. And for us, we begin by training and educating the merchant crews, and we have a particular standing which I think is important to note. In our crews, the officers and the unlicensed crew itself do have requirements under the Standards of Training, Certification, and Watch Keeping Convention. In addition, they have Coast Guard licensing regulations

to be aware of, and knowledgeable of, and they should be trained in anti-pollution techniques.

We feel that the Annex V requirement for garbage prevention, pollution prevention by garbage under Annex V, is a necessary part of our licensing process, and once Annex V is ratified and the necessary Coast Guard regulations are implemented, at that point, the officers will be tested on the upgrading of their license and on license renewal on these pollution prevention techniques.

Secondly, in the enforcement area we feel that the methods of compliance have to be flexible. Methods for a vessel operator have to be flexible to allow for the various operating techniques of the various ships. There are many methods which we can use to help us alleviate the problem such as compaction, grinding, incineration, and of course off-loading to shore facilities.

Shore facilities are an important aspect of the enforcement of Annex V, and we feel that the government under MARPOL has an obligation to ensure that there are reception facilities available. We feel that, when available, the associated costs should be borne by those who are using the facility.

Aboard the vessel itself, we feel that the ship and the ship company can and should have a plan to comply with the Annex V requirements and the implementing U.S. legislation. We feel that enforcement can be accomplished at this stage through log book entries. We feel that log book entries attesting that the refuse was handled in accordance with the regulations is the most plausible method to obtain compliance by merchant ship crews.

A final point, Mr. Chairman, concerning the legislation again is that we feel that there ought to be a legislatively mandated monitoring group. We feel that oceangoing merchant ships contribute to the problem, but by no means are the majority source of pollution by plastics, and we feel that the interests of all can be protected and in fact the problem can be best addressed by having a monitoring group monitor what is taking place to alleviate the problem. If one party which is a major contributor does not reduce its pollution then we still end up with an unacceptable amount of plastic in the water.

Thank you, Mr. Chairman. That concludes my remarks. I will certainly respond to any questions.

[The statement follows:]

STATEMENT OF JOSEPH J. COX, DIRECTOR, MARINE AFFAIRS, AMERICAN INSTITUTE OF MERCHANT SHIPPING

Good morning, Mr. Chairman, and members of the committees, I am Joseph J. Cox, Director of Marine Affairs, of the American Institute of Merchant Shipping, commonly referred to as AIMS. AIMS is a national trade association representing the vast majority of the U.S.-flag bulk fleet and a sizable portion of the dry cargo fleet. We are pleased to present testimony on the topic of plastic pollution in the marine environment and proposed legislation to control the disposal of garbage in the ocean.

Refuse, including plastics, in the marine environment is generated from a variety of sources. These sources include careless beach users, refuse disposed into rivers and streams which empty into the ocean, and from offshore sources. Offshore sources include private merchant vessels, public government vessels, fishing vessels, vessels engaged in offshore oil and gas activities, recreational boat users, and in some areas, municipalities. With the variety of contributors to the problem, we cannot accept the incredibly high estimates of the waste problem which some have attributed to commercial merchant vessels. In the mid-1970's, there were approxi-

mately 65,000 vessels over 100 gross tons in the world fleet. Today there are approximately 75,000. Of those, the vessels most probable to be engaged in deep sea trade, those over 1000 gross tons, numbered 23,000 in 1976 and number 25,000 now. The vast majority of vessels, which are the smaller vessels, would be expected to ply their trade, be it commercial, fishing, or recreation, near the shore where waste thrown overboard has the greater likelihood of ending up on beaches. For commercial merchant vessels the amount of garbage, including plastics, generated during a voyage depends on the type of vessel, the trade route, the length of voyage, the size of crew, shore facilities available to vessels in ports of call, and the facilities the vessel may have onboard to handle garbage. With respect to crew size, we believe that, for unrelated reasons, commercial merchant ships have lessened the amount of waste generated aboard ship. For commercial reasons, crew sizes have shrunk. Since the 1970's, we would estimate that vessels average a one-third crew size reduction based on job rationalization and redundant and automated equipment. However, while difficult to estimate amounts, it is not difficult to estimate and observe the harmful effects any plastics discarded in the oceans may have on the marine environment. American-flag shipowners support the fact that oceans and waterways should be free of these harmful plastics as, indeed, would anyone of reason. We believe this position should be mirrored by all parties who contribute to refuse in the oceans.

Historically, commercial merchant vessels have disposed of their grabage at sea in compliance with existing laws. Existing U.S. law under the Refuse Act of 1899 (33 USC 407) prohibits the disposal of any refuse matter, including plastics, from any source into the navigable waters of the United States, including the territorial seas. Generally, aboard merchant vessels on the high seas, wastes generated as a result of vessel operations and deck maintenance is disposed of directly overboard. Any of these materials which are non-plastic will sink or degrade in a short time. Wastes generated from the vessel's hotel areas (i.e. galley, crew accommodations, crew lounges, and dining rooms) are normally stored in sealed drums and placed in a garbage stowage area. The garbage is then discharged at sea through a disposal chute from the garbage stowage area or from the stern of the vessel. This must be done at regular intervals since garbage retained on board can quickly become unsanitary and even present a fire hazard. Again, materials which are non-plastic will sink or degrade and food wastes provide meals to marine life. It is common to have birds, marine mammals and fish follow vessels on their voyages to take advantage of these discharges. Recently, some vessels have installed incinerators which, among other applications, can be used for the disposal of vessel garbage. Other vessels, primarily those with restrictions on the amount of garbage which can be retained onboard or which operate in restricted disposal areas, have installed trash compactors and some vessels which must handle large amounts of hotel wastes have installed comminuters or grinders for more efficient disposal.

AIMS believes that since plastics are introduced into the marine environment from a variety of sources, both national and international, any ultimate solution to the problem must encompass every party contributing to the problem. We believe the solution for the commercial maritime industry must be international Specifically, we believe the solution is Annex V of the International Convention for the Prevention of Marine Pollution referred to as MARPOL. Virtually every aspect of the operations of vessels engaged in foreign commerce is subject to international regulation by the conventions of the International Maritime Organization (IMO). In addition, the U.S. laws and regulations governing vessels in domestic commerce are equal to the IMO conventions. MARPOL, which was drafted by the Marine Environmental Protection Committee of the IMO and adopted in 1973 then revised in 1978, has five annexes. Annex I controls bulk oil pollution and Annex II covers bulk chemical pollution from vessels. Annexes I and II were required to be accepted by nations as they ratified MARPOL while the remaining three were designated optional annexes. Annexes I and II are now in force internationally and have been incorporated into U.S. domestic law and regulations. The U.S. Coast Guard enforces the requirements on U.S.-flag vessels and on foreign-flag vessels within our territorial waters pursuant to the treaty.

As you are aware, Mr. Chairman, on February 9, 1987, the President transmitted Annex V to the senate for its advice and consent to ratification. AIMS supports Senate ratification. Once adopted, Annex V will apply to all ships. It will prohibit the disposal into the sea of all plastics, including synthetic ropes, synthetic fishing nets, and plastic garbage bags. Also, dunnage, lining, and packing materials which will float cannot be disposed of within 25 nautical miles of the nearest land and all other garbage including food wastes, paper products, rags, glass, metal and similar refuse cannot be disposed of within 12 nautical miles of the nearest land. In addi-

tion, governments are required to ensure that ports and terminals maintain facilities for the reception of garbage from vessels. Annex V will enter into force twelve months after the date on which at least fifteen nations representing fifty (50) percent of the gross tonnage of the world's merchant shipping ratify the treaty. Presently, 27 nations representing nearly 42 percent of the world's tonnage have ratified the annex. Ratification by the United States would add approximately 4 percent to the tonnage figure. Mr. Chairman, in our view, Annex V will soon become international law whether or not the U.S. ratifies. It is also our belief that Annex V, along with requirements which include a variety of compliance mechanisms, and enforcement through reasonable practices that encourage compliance on vessels of all nations, will have the desired result of eliminating the disposal of unacceptable plastics from ships.

Mr. Chairman, I would like to now address my comments to how we believe that Annex V can be most effectively enforced and proposed legislation to implement Annex V.

We support the intent of S. 560 and S. 633 which provides for the implementation of Annex V of MARPOL. We have no comments with respect to legislation which would require studies on the plastic pollution problem and its adverse effects. First, with respect to legislation implementing Annex V, we believe that Annex V should be incorporated into U.S. law by amending the Act to Prevent Pollution from Ships (33 U.S.C. 1901 et seq). The Act already provides the legal structure within U.S. statutes for implementing the MARPOL Annexes. While the Act specifically implements Annexes I and II of MARPOL, the legislation provides provisions for definitions, administration and enforcement, issuance and maintenance of certificates, reception facilities, reporting incidents, violations, amendments to MARPOL, legal actions, and the authority of the Secretary. These provisions are necessary for the successful implementation and enforcement of Annex V. We particularly believe that it is important for the U.S. Coast Guard to prescribe the implementing regulations and enforcement procedures for Annex V as called for in the Act. We understand that the Administration will soon submit a legislative package to Congress which will implement Annex V in this manner. Second, we have supported Annex V with the understanding that its requirements would be placed equally on vessels of all nations without placing the U.S. fleet at a further competitive disadvantage. United States-flag compliance with the Annex of itself will not solve the problem of plastics in our oceans. We believe that legislation creating plastic pollution control measures for private commercial and recreational vessels should provide that upon U.S. ratification of Annex V the provisions of the Annex be incorporated into the existing U.S. law within a reasonable time period, and that the Secretary of the Department in which the Coast Guard is operating prescribed regulations to carry out the provisions of Annex V.

Third, we cannot support legislation which would extend U.S. jurisdiction to foreign vessels within or beyond the exclusive economic zone (EEZ) of the United States for violations of the prohibition on the disposal of plastics. The MARPOL Convention contains specific regulations on enforcement which apply to all Annexes. The procedures call for state enforcement of the regulations on its vessels in all waters and on all vessels within the state's territorial seas. Violations outside a state's territorial seas are to be reported to the flag state for action. We believe that if this procedure is not adhered to in enforcement of Annex V, other nations may be discouraged from ratification and there may be further implications with respect to Annexes I and II. In addition, U.S.-flag vessels could face complications in foreign ports for reported violations. We would support U.S. policing action within the EEZ although we feel that port state action in that area would have negative results.

We would now like to comment on the enforcement aspects of Annex V. There have been many questions raised concerning how Annex V can be most effectively enforced. As we have stated, for this treaty to have the desired effect of eliminating plastics from our oceans, the enforcement methods should encompass all parties responsible for the problem, and should encourage compliance with the treaty. With respect to the commecial maritime industry there are a number of enforcement components. First, we believe that the training of merchant vessel crews in proper garbage handling, the provisions of Annex V, and the effects of plastics on the marine environment, will be an important aspect of compliance.

Under the International Treaty that sets requirements for the training of merchant crews, the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers, 1978 (STCW), both officers and unlicensed seamen must show knowledge of international pollution regulations and protection of the marine environment. Once Annex V is ratified, its provisions will become part of the required training. The STCW treaty has not been ratified by the U.S. although

our training in this country includes all pertinent aspects of pollution prevention. In renewing their licenses and for upgrading, officers are required to take a test in marine environmental pollution. The Coast Guard could add aspects of Annex V to that test when the Annex comes into force. Second, vessels must have flexibility in compliance methods. These methods, which may include minimizing the amount of potential garbage, onboard handling procedures, onboard processing equipment, and disposal ashore, will vary among the many types of vessels and may vary aboard the same vessel depending on the nature of the voyage. While maintaining that flexibility, a ship or company should have a plan for how Annex V waste will be handled. It should be recognized that plastics cannot be thrown into the sea and must be disposed of by incineration at sea or discharging in port to reception facilities. Third, we believe that the availability of shoreside reception facilities for Annex V waste to be absolutely essential for the successful implementation of Annex V.

The Act to Prevent Pollution from Ships and Coast Guard regulations for Annexes I and II provide a legal foundation for ensuring facilities are available. Reception facility regulations are in place for oil and chemical wastes and the Coast Guard is reporting a very high compliance rate. Reception facilities meeting Department of Agriculture Regulations can be made available through the same procedures. In using the word facilities, with respect to garbage, we recognize that government approval could be granted to presently operating commercial waste handlers. However, the government must ensure that facilities established will take vessel garbage under all circumstances. One only needs to recall our infamous garbage barge ordeal to foresee potential problems. Yet we are hopeful that marketplace and government requirements will alleviate such problems. Any charge for use of facilities should be borne by the user. If facilities are recognized, the market place will provide the competition to keep costs in line and agreeable to vessel owners. Fourth, we propose that placards pertaining to Annex V regulations and garbage dumping restrictions be placed aboard vessels. This will serve as a reminder to vessel's crews and supplement training requirements. Fifth, we propose that when vessel garbage is discarded, a logbook entry be made attesting that the disposal was made in compliance with Annex V regulations. The logbook can be made available to the Coast Guard and Department of Agriculture during routine vessel boardings. Logbooks are an integral and traditional part of the maritime industry. They provide evidence of compliance with many other laws and regulations including environmental and safety measures. They establish a record, are completed by licensed individuals who place their license in jeopardy for false entries, and can be relied on in this matter.

We feel that the above noted enforcement aspects are reasonable and will be complied with to the benefit of cleaner oceans. One idea we have heard discussed, which is enforcement based on mandatory presentation of garbage before a shore-side overseer, will in our opinion, engender non-compliance leading to deliberate contravention of Annex V. In addition, we suggest that the enforcement requirements be placed in regulation rather than legislation so they can be revised easier if necessary to ensure the Annex provides the intended results.

Lastly, Mr. Chairman, we have a major concern. In the first part of our testimony, we noted the unfair, and we believe grossly inaccurate, characterization of commercial maritime vessels as the primary source of pollution. We are less interested in disavowing those who hold this view than we are in reducing our contribution to the problem. We help make the mess so we'll help clean it up. But what about the other contributors? As one small example, we recently witnessed, in the Houston ship channel after a downpour, literally thousands of styrofoam containers in the channel from municipal run-off. The sad fact is those containers will not degrade for many years. It is also sad that as commercial merchant ships are identified as the primary contributor to beach waste now, no matter what alleviation of our contributed portion we attain, the criticism of commercial merchant vessels as the prime culprit will not diminish. Therefore we would support a legislatively mandated monitoring group to periodically review the entire question of trash pollution. Those with interests in the matter, such as shipowners, environmentalists, state authorities, federal government authorities, fishing, and recreational boaters, would be a part of the group. We believe this would give us, the commercial maritime interests, a forum to discuss our activities and reduce unfair attribution which would help perpetuate the problem rather than solve it.

Mr. Chairman, we have a common goal to rid our waters and beaches of plastic pollution. We appreciate this opportunity to testify and we look forward to continuing to work with you and the Subcommittee to accomplish our goal. Thank you.

Senator BREAUX. Thank you.

Dr. Brown.

Dr. BROWN. Thank you, Mr. Chairman. It is a pleasure to be here to testify on plastics pollution in the marine environment, and it is also a pleasure to be before you on this side of the Capitol for the first time. I have had the pleasure of being in front of Senator Bentsen here before, but never you on this side.

Waste Management, Inc., is the largest municipal and industrial waste handling company in the world, with operations on five continents. We have more than 400 divisions in the United States located from coast to coast. By my count, these include 19 divisions in Louisiana and 21 in Texas.

The waste in the sea is part of the larger problem of waste in our society. The statistics are riveting. Each year the United States produces more than 250 million tons of hazardous wastes, 136 million tons of municipal refuse, more than 10 billion tons of other solid wastes, much discharged into some 191,000 waste ponds scattered across the country.

We produce some 433,000 55 gallon drums of commercial low level radioactive wastes and well over one trillion gallons of sewage.

Other nations carry similar kinds of burdens. Ship-generated waste are a small volume of this larger problem, but they are acutely hazardous in the form of plastics that entangle organisms in the sea and fill their stomachs, and plastics are particularly unattractive as persistent coastal debris.

If the limited Agriculture Department statistics that we have are representative, effective enforcement of MARPOL Annex V may generate about one quarter of a million tons of shipboard waste per year at U.S. ports. The Agriculture Department through its APHIS Bureau requires offloaded foreign garbage to be incinerated or sterilized by cooking, as you have heard.

APHIS generally does not allow raw garbage to be transported through rural areas for ultimate incineration, although I understand that exceptions to that rule are sometimes made.

The Center for Environmental Education ("CEE"), whose board I chair, has summarized for the Committee current knowledge on discarded plastics in the sea and their impact on fish and wildlife and the environment. That impact is substantial and something should be done about it. Hundreds of thousands of sea birds, some 30,000 northern fur seals, sea turtles, and many other creatures die each year from entanglement in plastic nets and other debris. Some 50 species of sea birds and several sea turtle species are known to eat plastics debris, which can lead to starvation.

A three-hour long Texas beach clean-up organized by the CEE produced 125 tons of trash from 122 miles of coastline—more than a ton per mile. Plastics made up 56 percent of the trash. I find it striking that ships apparently produced most of the trash removed form Texas beaches in the clean-up. Motorists in our society are obliged not to toss garbage from the windows of cars or trucks driving down the road. Captains and crews of ships, big and small, should observe a similar duty.

Waste in the sea is part of a large problem of waste in our society. The statistics are staggering; each year the United States produces more than 250 million tons of hazardous waste; 136 million

tons of municipal refuse; more than 10 billion tons of other solid waste, much discharged into some 191,000 waste ponds scattered across the country; well over one trillion gallons of sewage; and some 433,000 55-gallon drums of commercial low-level radioactive waste. Other nations carry similar burdens. Unless managed properly, this waste can degrade environmental quality and cause disease. A brief description of keys problems created by these wastes is given in the attachment to this testimony.

Ship-generated wastes are a small volume of this larger problem, although they are acutely hazardous in the form of plastics that entangle marine organisms or fill the stomachs and particularly unattractive as persistent coastal debris.

The CEE has stated that an estimated 7 million tons of trash are discarded by ships at sea each year. Statistics of the Department of Agriculture reviewed by Waste Management staff indicate that in FY 1986, 73,614 vessels entered U.S. ports, of which 50,049 originated in a foreign port. Of the 73,614 vessels arriving in U.S. ports, 1,832 off-loaded garbage and other ship wastes. The volume was approximately 9,000 metric tons, or about 5 tons per vessel. We do not know if these statistics are representative of larger ships generally. If they are, effective enforcement of Annex V may generate at U.S. ports in the neighborhood of one-quarter of a million tons of shipboard waste per year. The amount will be reduced to the extent that ship-board incinerators are put into operation or that non-plastics are separated from trash and dumped at sea.

The Agriculture Department requires off-loaded foreign garbage to be removed under the direction of an Animal and Plant Health Inspection Service ("APHIS") inspector "to an approved facility for incineration, sterilization, or grinding into an approved sewage system" (9 Code Fed. Reg. 94-5(b)(1)), or for other handling approved by APHIS. My discussions with APHIS staff indicate that off-loading of garbage containing plastics will be allowed only if the garbage is incinerated or sterilized. Sterilization is defined as "cooking garbage at 212 degrees F. for 30 minutes and disposal of the residue by burying in a landfill . . ." APHIS generally does not allow raw garbage to be transported through rural areas for ultimate incineration, although I understand that exceptions are sometimes made, nor does APHIS allow just any incinerator to be used I am told—they require demonstration of a thorough burn.

Despite these Agriculture Department requirements, I believe that the ports and ship owners and operators can count on our company and others as willing and able commercial partners for proper treatment and disposal of waste offloaded at most ports.

Many of the major ports already have access to facilities that should be adequate. For those that do not, it should be possible to site incinerators or cookers of some kind, although, as you know, incineration is controversial and siting is typically protracted.

With the possible exception of remote ports, it should be feasible to establish and operate facilities without underwriting from the Federal Government. Ports or some form of appropriate local government, however, may help to site facilities by serving as coordinators or sponsors.

A local user fee payable to the ports or local government might help the process in some cases. I understand, for example, that this

is done in Montreal, where vessels are charged about $13 Canadian per day in port, whether or not they use the port's garbage removal service.

Incineration at existing municipal facilities is likely to be less expensive than incineration or cooking at new facilities placed at ports for this purpose. Furthermore, remote ports present a special problem because the volume of garbage may not justify commercial investment in new facilities.

For these reasons, it may be wise for the Agriculture Department to authorize waste transport through rural areas if necessary to reach an existing incinerator. The Department could require any necessary measures to ensure that domestic or wild animals will not gain access to the trash.

The EPA and the Department of Transportation, as you know, currently oversee detailed requirements for transportation of hazardous waste and product chemicals. Agriculture could draw on these programs to the extent necessary.

It ought to be easier to keep pigs out of the trash than hydrofluoric acid out of the air.

Enforcement in my view is the key variable on which the success of MARPOL Annex V will stand or fall. Unless enforcement is effective, I fear that many will dump trash at sea, as they have done until now, because of convenience and cost.

I believe that MARPOL Annex V implementing legislation should give the Agriculture Department a mandated role in the enforcement of the law. As they have testified, the Agriculture Department currently inspects most offloaded foreign garbage. I believe they said here last week—I did not hear it this week—that they cover something like 60 percent of the ships that come in. This would be a new task for the Coast Guard and one in which they have had little experience, and one which would compete with other priority activities that they have, such as controlling the drug trade.

Nothing is more important to Agriculture's APHIS Bureau than preventing introduction of foreign disease-carrying biotics. I get the impression from talking to their staff that they know the garbage on ships very well, and it seems to make sense and really to be cost effective to use them in any enforcement-related inspections under the MARPOL treaty.

This would not be the first time they have had a conservation mandate, as well. They were given responsibilities, as the Chairman knows, under the Endangered Species Act to enforce trade in wild plants, and they are doing that now, despite the fact that their original mandate was just to keep those wild plants out of the United States. And I think they could do the same kind of thing here.

At a minimum, it would seem absolutely necessary for records to be kept of trash discharges. It looks like there is a lot of support here for doing that. A log could be kept for this purpose.

The log would be used for rough statistical information and enforcement. An experienced APHIS or Coast Guard inspector might review logs most closely when little or no trash is offloaded.

If the records look odd in light of the particular circumstances, an inquiry could go further. In other words, if a ship comes all the

way from Tokyo to Seattle and it does not have any trash, that is funny.

If the implementing legislation provides significant penalties for falsification of logs or negligence in recordkeeping, then deterrence will exist. To be effective, a log keeping requirement should also apply to foreign vessels as well as domestic vessels at U.S. ports.

Except perhaps during warfare, I believe that the implementing legislation should require public vessels to observe standards of trash disposal no less strict than those required for private vessels.

Although the MARPOL treaty provides an exemption to these public vessels, stricter domestic measures are authorized under the treaty. You can pass a law here consistent with the treaty that requires them to do the same thing as the private ships.

And all you would be doing, I think it is important to bear in mind, is requiring the same thing that would be required, for example, on large luxury liners, which also have thousands of passengers. There are private industry parallels where a prohibition on plastics would be flat-out required on ships with similar kinds of densities of people. The Navy can be very creative and, with some changes in management, they ought to be able to keep their tenth of a pound per person of plastics on board their ship, if that is what it comes down to, and take it back to port.

Public education, I would agree with all of the previous witnesses that mentioned it, is critical to making MARPOL Annex V work. Many recreational boaters probably will not even be aware of the law unless a major education effort is launched.

NOAA is already undertaking a solid public education effort in conjunction with the Center for Environmental Education. This ought to continue, and I commend to you the Center's recommendations as well as the Coast Guard's for MARPOL Annex V notices on larger ships and at ports paralleling those notices required for oil.

Thank you very much for the opportunity to be here.

[The attachment referred to follow:]

Attachment

THE WASTE PROBLEM

Without sophisticated management under strict environmental laws and enforcement, the waste produced by our society can degrade environmental quality and cause disease.

I. Millions of tons of waste are produced each day in the United States alone. The statistics are staggering: each year our country produces more than 250 million tons of hazardous waste; 136 million tons of municipal refuse; more than 10 billion tons of other solid waste, much discharged into waste ponds on the properties of industrial plants; well over one trillion gallons of sewage; and some 433,000 55-gallon drums of commercial low-level radioactive waste. Other nations carry a similar burden.

II. Unless managed properly, this waste can degrade environmental quality and cause disease.

Solid Waste

° Unregulated disposal of refuge, still occurring in parts of the world, can give rise to visual pollution, unpleasant odors, hordes of flies, other insects, rodents, and disease. Historically, the Black Plague was fueled by unsafe waste disposal and killed one half of the 120 million people in Europe.

° Open burning at disposal sites is still widespread in the developing world and was practiced widely in the United States until the last few decades. This burning reduces volume and suppresses disease-carrying organisms, but causes excessive air pollution.

° Even in the United States, current disposal practices remain less than perfect, despite well understood tools for preventing harm to the environment. Recent EPA statistics show that most solid waste landfills still lack systems for determining whether any groundwater contamination is occurring. Some landfills accept liquid wastes and others make little or no effort to identify hazardous wastes that should not be accepted. Industrial waste ponds are worse. The 191,000 waste ponds in the United States typically were sited and designed without particular regard for potential groundwater contamination and lack groundwater monitoring systems. Unlike landfills, these on-site solid waste ponds are virtually unregulated. They are, quite simply, out-of-sight and out-of-mind.

Sewage

° Untreated discharge of municipal sewage remains one of the developing world's greatest threats to human health and the environment. Diseases are transmitted through contaminated drinking water and aquatic ecosystems can be altered or destroyed. Organic matter, for example, can lead to oxygen depletion in rivers and lakes, and nitrogen and phosphorus stimulate algal growth. Systems are available for sound treatment of sewage and waste waters and are in place in the United States. Even here, however, these facilities are not always well operated and maintained.

Hazardous Wastes

° Certain wastes present special hazards and must be managed with great care. Best known of these are chemicals that are thought to cause cancer (e.g., dioxins, PCBs, DDT) or developmental defects (e.g., lead). Hazardous wastes also include materials that readily ignite (e.g., residues from dynamite manufacture), that are corrosive (e.g., acids and bases used in industry), or that are reactive (e.g., certain acids that react violently on contact with water).

° Compounding the problem of safely managing hazardous waste produced today is the legacy of past mismanagement. Thousands of abandoned sites, such as Love Canal and the Stringfellow Acid Pits, dot our country from coast to coast and require clean-up. In some developing countries without strong environmental laws, these sites are being created unchecked.

° Although very strict hazardous waste laws are in force in the United States, lack of regular and comprehensive inspection and enforcement undermines their effectiveness. Some facilities have never even been visited by a government inspector; few have been subject to detailed scrutiny. Furthermore, illegal "midnight dumping" is a regular occurrence.

Radioactive Wastes

° Radioactive wastes are produced by weapon development and production, nuclear power plants, hospitals, research laboratories, and various industries. Excessive exposure can cause reddening of the skin, loss of hair, damage to blood-forming organs, genetic changes, malignancies, and reduced fertility and life span. High level radioactive wastes are managed by the federal government in the United States; highly regulated private management is allowed for low-level wastes. Sound containment and monitoring technology is in use at private sites, but only three such sites are operational nationwide and political controversy dogs them. In 1979, governors of the three states involved announced closing or restricted use of these sites. These strictures were lifted only after certain hospitals and laboratories announced that nuclear medicine and laboratory services would be halted.

Senator BREAUX. Thank you very much.

Next we will hear from Mr. Freeman. And Mr. Freeman, I talked with Margaret Rogers on your staff and she told me all about plastics. We are glad to have you.

Mr. FREEMAN. So any terms I use you will be able to understand.

I appreciate being here this morning to testify before the committee as it explores the problem of debris. I am Lew Freeman, Vice President of Government Affairs for The Society of the Plastics Industry. We are the principal trade association for that industry.

My testimony will review our understanding of the marine debris problems being caused by plastics and our views on possible solutions. The Society supports the responsible use of our industry's materials and the responsible and proper disposal of those products after they are no longer needed.

We recognize that the problem with improper disposal, particularly in the ocean, can sometimes create environmental problems. Among the problem areas of which we have become aware since marine debris became a prominent issue are:

—The commercial fishing industry: fishing gear, primarily netting, that is lost or discarded at sea;

—The marine shipping industry and the naval fleet: millions of tons of trash that are dumped overboard by merchant ships and naval vessels every year;

—Boaters and beachgoers: picnic utensils and six-pack yokes that are improperly discarded along the nation's beaches and waterways:

—Municipal storm and waste sewers: antiquated sewer systems that allow debris to be washed into the oceans and onto the beaches; and

—Plastics manufacturing: resin pellets that by various means make their way from plastics processing plants into the marine environment.

Certainly most of these sources involve forces outside the direct control of the plastics industry. However, we are concerned about all of the sources of plastics debris in the ocean, and we recognize that as an industry we can and should be involved in helping to find ways to address all dimensions of the problem.

First, I would like to discuss one segment of the problem that the plastics industry can address directly. That is the problem of plastic resin pellets that are sometimes found in the ocean, more specifically found in the stomachs of birds and other marine life.

Plastic resin pellets are the raw materials supplied by resin manufacturers to the literally thousands of processors around the country, who remelt the pellets and form them into usable plastic articles. In initial discussions of this question with industry members, we have identified two possible ways that the pellets find their way into the ocean: transportation accidents through spills or losses in either ship or transportation by rail near bodies of water; or plant outfall.

Last fall, shortly after we became aware of this problem, we held an all-day meeting with representatives of our major resin companies to discuss it. We learned that several steps have already been taken in recent years to remedy resin pellet losses.

For instance, one company operating in Louisiana and Texas, on discovering the problem, made a videotape of the steps they have taken and are continuing to find better ways of recapturing resin pellets that might come out through their resin plant outfall.

We are currently conducting a comprehensive survey of industry practices in containing resin pellets. Information gathered thus far indicates that most of the problem of pellets escaping from resin plants may well have resulted from past practices that have now been corrected.

We have less information right now on transportation accidents until we receive the results of our survey. However, conclusions would be premature.

I think it is important to point out in passing that, as much as we might do to try to correct the resin pellet problem in the United States, less than 30 percent of the plastics resin manufactured in the world come from the United States.

In recent months, mindful of that, we have initiated discussions with our counterparts in other countries and we hope to have more information on practices as well as other dimensions of the marine debris problem internationally later this year.

That brings us to MARPOL. Certainly this is an international problem and SPI supports the ratification and the full implementation of Annex V. We believe the provision is important because it enforces the point which our industry strongly believes in: Plastics, for all of their multifaceted benefits to society, should not be discarded in the ocean.

We believe ratification would also have another important benefit. It would help heighten public awareness of the issue of marine debris.

And that brings me to a final point, and that is public education. You have heard already from most witnesses about it, and we cannot underscore too much the importance of changing people's habits as to how they deal with their garbage near the ocean.

The problem of marine debris is first and foremost a people problem. Our industry understands why plastics have become a focal point of the marine debris issue: We have the unique characteristics, they are durable, they are light, they do not corrode, and certainly in recent years we have become more prevalent in many product markets.

However, there will still be a marine debris problem with or without plastics as long as a growing and affluent world population continues the overt and sometimes covert practice of using the oceans of the world as a convenient place to put waste.

There was a time when waste was dumped in the streets. Society stopped doing that when it became apparent that the public health was threatened by the practice. We think that it is time that the same approach be applied to dumping waste in and around the marine environment.

Over the past year since becoming more aware of the problem, the SPI, in cooperation with the Center for Environmental Education, has begun developing a public education program to address the improper disposal of plastics in the marine environment.

Our first major project will be a series of public service advertisements for trade publications in the commercial shipping, commer-

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cial fishing, and plastics industries. The advertisements and appropriate backup materials are different for each industry group, but the ultimate message is the same for each: Do not discard plastics in the ocean.

We hope to have these advertisements appearing in publications in these industries some time in the fall. And we are also pleased to note that the National Oceanic and Atmospheric Administration will be a co-signator on these advertisements.

Finally, I would like to turn my attention to the subject of degradability, which has been mentioned prominently today. Degradability is one of the increasingly suggested solutions to the problem of marine debris, marine plastic debris, with the wider use of such products.

Plastics are not inherently degradable, but because of the widespread interest in the possibilities and the limitations of plastics being made degradable SPI sponsored in June of this year a symposium on degradable plastics. We were pleasantly surprised that it was attended by more than twice as many people as we expected, over 300 people filling the room at the local hotel where we held it.

While we are still evaluating the many technical presentations made at the gathering, there were some common themes, in many of the papers and speeches presented:

First, promising work is being done to make some plastics either biodegradable or photodegradable;

Secondly, there are decided limitations on what products may or may not be suitable for degradability. For instance, performance, including safety, requirements of some products could be compromised by necessary steps taken to make them degradable.

And thirdly, research and market experimentation with degradable plastics will be continuing. However, it is not in the interest of the consuming public or, we believe, consistent with sound environmental practices for degradable plastics to be pushed as a panacea for solving the marine debris problem.

There are many unanswered questions about the effects of degradable plastics. For instance, we need to know more about the environmental impact of byproducts resulting from the degradation process.

Further, we need to know about what the impact is on additives for degradation in plastics packaging material that would be intended for food contact purposes.

In conclusion, we continue to believe that public education encouraging proper disposal of plastics and other materials is the most effective way to reduce harm in the marine environment.

Thank you.

[The statement follows:]

SPI Symposium on Degradable Plastics

REMARKS OF C. E. O'CONNELL

President, The Society of the Plastics Industry, Inc.

Good morning . . . and welcome to what we believe will be a very enlightening day of presentations and dialogue on the subject of degradable plastics.

Today promises to be more than a purely technical event. Thanks to several events in recent months, degradability has become an integral part of a larger discussion—that of solid waste management and litter control. It is in the context of this larger issue that we come together today—to discuss not only how some plastics can be made to degrade, but also whether some should be made to degrade.

For more than a month this spring, national attention focused on a garbage barge—the scow without a country—that was unable to find a place to drop its cargo . . . every landfill between New York and South America, it seemed, was full or otherwise unwilling to accept the load. Legislators, reporters and environmentalists across the country eagerly took the opportunity to use the barge . . . as a symbol of the nation's emerging solid waste disposal crisis.

Even before the barge saga began, we at SPI were feeling pressure from various publics wrestling with the solid waste issue.

Legislators, for instance, in more than a dozen states, have introduced bills targeted specifically at post-consumer plastics . . . materials they often consider to be particular problems in the waste stream. Sometimes, in their search for answers, they have latched onto the idea of degradability as a possible solution.

In New Jersey, for instance, one lawmaker is seeking to ban non-degradable egg cartons . . . another, non-degradable tampon applicators. Berkeley, California—like the state of Michigan a year ago—is considering a ban on all non-biodegradable fast food packaging. In Oregon, the legislature is debating a ban on plastic grocery bags and nondegradable diapers. And Senator John Chafee of Rhode Island—who will be our lunch speaker today—has introduced a bill in Congress that, among other things, would ban non-degradable six-pack loops nationwide. Already 11 states require that these items be degradable . . . and the list goes on.

In the popular press, as well, attention is focusing on degradability. Numerous stories in recent months have reported on the dangers of plastics items in the marine environment. Others have featured certain products, like garbage bags or agricultural films, that are being made from degradable resins. Because of stories such as these, levels of expectation are being raised as to what degradability can or should achieve.

As the interest in solid waste, litter and degradability has grown, we have become aware of how little definitive information we as an industry have assembled on degradability—not only the technology behind it, but also the potential applications for it.

Legislators, reporters and environmentalists frequently are asking us questions to which we have no firm answers . . . questions about whether plastics can be made to degrade . . . whether they should be made to degrade . . . and in what applications it would be advisable to make them degrade.

The answers are not going to be easy to find . . . but our purpose in coming together today is to lay the foundation for developing some of those answers.

The idea of making plastics degradable is not a new one. Back in the early 1970s, protection of the environment was a high priority which resulted in the adoption of many beneficial laws and industry practices. It was about this time that "biodegradable" became a buzz word . . . which for many people implied an easy solution to a myriad of problems, including that of litter.

An emotional sense of well-being often accompanied the concept of degradability . . . and it persists even today among those who view it as a panacea in alleviating both litter and waste disposal problems . . . it could be a placebo rather than a panacea.

Quite a bit of research was done back then on degradability and plastics . . . and in many cases, technological developments were spurred by public and political pressures.

Today, that pressure has resurfaced—and is building rapidly. Once again, concerns about the environment are dominating legislative agendas as well as the editorial pages of daily newspapers.

Let's look for a moment at the reasons behind this interest in degradable plastics. Just what is it that the public is expecting from degradability? The answer, I believe, is two-fold.

First, it is seen as a solution to the persistent problem of unsightly litter. When products of all types . . . including plastics . . . are carelessly littered on roadsides and beaches, we all agree that they create an aesthetic problem. And, particularly in marine environments, this litter is seen as more than unsightly . . . it is believed to be an environmental problem that threatens the safety and health of many ocean mammals and seabirds.

Our belief is that education is the key to eliminating litter—it is, after all, primarily a problem of behavior—people who litter do so either because they don't think or don't care. But with a well thought out and implemented public awareness and education program, we believe that we can get the thoughtless to think . . . and the careless to care . . . with the result being a marked reduction in litter of all sorts.

To this end, SPI has been working with the Center for Environmental Education . . . a conservation organization dedicated to protecting marine wildlife . . . to develop public service advertisements and educational materials geared toward the maritime, commercial fishing, and plastics industries—those industries believed to be key players in the marine pollution problem.

But education programs are not likely to result in immediately observable solutions . . . so some groups, in hopes of seeing

more short-term results, are seeking to ban materials that they feel are more persistent in litter—and therefore less desirable in the environment—namely plastics. The perceived need is for materials that degrade quickly in the environment when they are littered. However, even most "traditional" materials, like paper, glass and aluminum, don't meet this criterion.

Some of the legislation that has been proposed calls for plastics to degrade within 90 to 120 days . . . but surely those who would ask for such a requirement do not realize that this is a goal that cannot be met by any of the so-called "traditional" packaging materials . . . and so, in effect, plastics are being singled out. Certainly aluminum and glass . . . and even paper . . . do not "disappear from view" in such a short period of time. They may, in fact, persist for months or even years before the natural forces of wind . . . rain . . . rust and decay . . . eliminate them from sight.

Likewise, those who wish to ban certain plastics might not realize that they could be replacing superior-performance with possibly less desirable materials . . . that do not degrade nearly as fast as they wish to believe.

The second reason behind the push for degradable packaging materials has to do with the solid waste disposal crisis that I mentioned earlier. According to a recent study, one out of every four states is expected to run out of landfill capacity by 1990. Because it is extremely difficult to site new, politically acceptable landfills and resource recovery facilities, municipalities are looking for ways to extend the useful lives of their existing landfills. One way, some decision-makers figure, is to make the solid waste that goes into the landfills degrade faster, therefore making more room.

Now the logic behind this motivation may be faulty . . . and it can be argued that nondegradability may even be an advantage in landfills—because, for instance, degrading waste can cause the build-up of explosive methane . . . or can cause hazardous leachate or groundwater contamination. But when faced with a crisis, the mere perception that degradability can ease landfill burdens may be enough to cause a public outcry for action from the plastics industry.

So it is with these perceptions in mind that we come together today to rekindle the plastics industry's interest in examining applications and markets for degradable plastics . . . where there may be a need. At the same time, we must keep in mind several questions that must be carefully examined before we can determine where degradability truly is feasible, and not just technically possible.

For instance:

- What really are "appropriate" applications?
- In what types of products would the desirability of degradability outweigh the need for durability or integrity in a package, for instance?
- What effect would chemical modifications in a polymer have on the ability of a food or beverage package to assure safety from microbial contamination?
- What impact would these chemical modifications have on the recyclability of these polymers?
- What would be the by-products of decomposition of these materials? Would the perceived environmental benefit of degradability truly outweigh the possible hazard of undesirable by-products in the ground or air?
- What would be the true effects of degradable plastics on easing litter problems or landfill burdens?

We also must keep in mind that while most of the debate we hear today concerns packaging materials, only one-quarter of plastics are used in packaging. Many of the other applications are in markets like building and construction . . . or transportation . . . or medicine . . . applications where durability is more than a benefit—it is an absolute necessity.

Remember, too, that durability in packaging materials is not the only reason that the users of plastics packaging chose them over "traditional" materials—their light weight and virtually limitless design possibilities are unmatched by competitive materials. But even more important are the safety advantages provided by their shatter resistance . . . which has made glass bottles virtually obsolete in both bathroom and laundry products.

During the next few hours, we will hear from researchers who can explain to us what is meant by the term degradable . . . and what is known about making different polymers degrade. We'll hear presentations of papers from people who have developed technologies to make certain plastics degrade . . . and from others who are marketing products that take advantage of these technologies.

I hope that by the end of the day we will have enough information to go away thinking about plastics, and particularly plastics packaging, in a new way.

We are being asked to think about product design from the cradle to the grave . . . and as a responsible industry, we must give serious thought to the ultimate disposal of our products after their useful life is finished.

I doubt that we will come away with many answers today . . . but as far as I am concerned, that is not really our goal. If we can come away with an appreciation for the difficult questions . . . and an awareness of the perceived needs . . . we will be that much closer to determining just where degradability is truly feasible, both today and in the future.

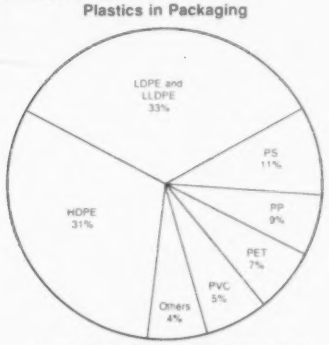
AN SPI OVERVIEW OF DEGRADABLE PLASTICS

Plastics, relatively new materials, have become almost as ubiquitous in use as such centuries-old materials as glass, metals, paper, wood, and masonry. Plastics are synthetic polymers, as opposed to natural polymers such as cellulose, starch, and natural rubber, and have replaced the old materials in many applications. Since their introduction into commerce in 1868 when cellulose nitrate was used to make eye glass frames, the types of plastics have proliferated to become the materials of choice in hundreds of old and new uses. The growth of plastics was accelerated by World War II when plastics became critical to electronics and communications, particularly in hot, humid environments where many other materials deteriorated or decomposed. Plastics' light weight, inertness, safety, permanence and economics are the properties largely responsible for their value. In the U.S. today, the volume of plastics used exceeds that of steel.

Plastics is a generic term like "metals." Plastics can be as different from one another as is iron from aluminum or lead from gold. Some are transparent, some flexible, some rigid, but generally they are light weight, inert, resistant to microbial attack and safe in use. All are synthesized from petrochemicals, air, and other natural substances to create long-chain molecules whose structure determines each plastic's unique properties. Scientists have learned to control the synthesis and thus, within limits, tailor-make plastics with properties and cost needed for various applications.

In 1986, 75 percent of the 45 billion pounds of plastics sold in the United States were converted to long life applications such as in transportation, health care, and construction markets, and 25 percent were utilized in packaging and other short life uses. (1) The 11.5 billion pounds used in packaging consisted of the following plastics:

Plastics in Packaging



Source: *Modern Plastics*, January, 1987, pages 56-62

These plastics were used in the following industrial, institutional, and consumer packaging applications:

Plastics in Industrial, Institutional and Consumer Packaging

Source: *Modern Plastics*, January, 1987, pages 56-62

Films for wrapping and laminating, and for bags were made from all six of the major packaging plastics. In many applications, plastics films have replaced coated papers, metals, and glass packages and have permitted innovative packaging applications like the "boil in the bag," which none of the other materials could. In addition to their economic benefits, the plastics provide transparency, inertness, i.e., resistance to the packaged item and the surrounding environment, and an excellent barrier to the transfer of odors, gases, and moisture. Polyethylene is the most used plastic for films where toughness and moisture barrier properties are needed. It is the film from which trash bags are made. PET films provide barrier to gases and may be used at higher temperatures, i.e., boil in the bag. Much of the film is converted to bags or pouches which frequently are used with other materials, such as the plastic film bag containing cereal inside of a paperboard box.

Bottles also utilize the same six plastics as films. Plastics have become the preferred material for a number of reasons, a principal one being safety. Plastic bottles rarely break when dropped, thus eliminating sharp cutting fragments. Plastic bottles are typically eight to ten times lighter than glass which enhances handling and markedly reduces transportation energy and costs. Again, polyethylene is most used for its toughness, moisture barrier, inertness and low cost if transparency is not required. Milk, bleach, and automotive chemicals are packaged in polyethylene bottles. When transparency is important, polystyrene, PVC, and PET are used. Combined requirements of transparency and gas barrier utilize PVC or PET. The plastic beverage bottle is made from PET which retains the carbonation, and some cooking oil bottles take advantage of the protection from oxygen provided by PVC.

Containers other than bottles include boxes, cups, tubs, and pails used by food service establishments for sandwiches and

meals. Plastics have replaced metal and coated papers for many of these uses. Polyethylene, polypropylene, and some forms of polystyrene are now used in place of coated paper for tubs to package cottage cheese and other dairy products because of their light weight and resistance to permeation by microorganisms. Tough polyethylene pails have replaced steel for various liquid products ranging from foods to building materials because of their resistance to oxidation and excellent strength-to-weight ratio. Because of their moisture barrier properties and resistance to breakage, transparent polystyrene and PVC are made into boxes and jars formerly made of metal or glass to contain products from medications to hardware items. Foamed polystyrene has replaced paper for egg cartons and trays for packaged meats and, because of its excellent insulating properties, it also is used to make the popular hot or cold drink cup and food service clam shells.

Nearly 10 percent of plastics used in packaging is as coatings on other materials, much of it on paper. For instance, both sides of the familiar paperboard milk carton are coated with polyethylene to protect the paper and the milk. To provide protection from deterioration, paper or metal foil used for packaging is often coated with plastic where there is contact with moisture, grease, oils, or chemicals. In food packaging applications, the plastic is the inner or food contact surface because of its inertness and compatibility with foodstuffs. Without a plastic coating, traditional materials like paper could not be used for bags, pouches, and boxes which are so important to packaging of foods.

The last category of packaging made of plastics is closures like screw caps and snap lids. Most of these, which were formerly made of metal, are now made from polypropylene or polystyrene. Versatile plastics have eliminated the rusty binding of steel screw caps, and in many cases, reduced the need for gasketing material. Snap-on lids, such as those furnished with cans of coffee grounds, provide a closure which was not possible without plastics.

The above examples illustrate why plastics have replaced traditional materials like papers, metals, glass, and wood in many established packaging applications and have permitted innovative new packaging which is not possible with traditional materials alone.

The unique properties of importance to use in packaging are the following:

Lightweight. Compared to glass and metal and, in some instances, paper, plastics permit lighter packaging resulting in savings in energy, transportation costs, and disposal weight.

Protection. Plastics have unique barrier properties. Some protect against the passage of either moisture or gases, some only moisture and some mainly certain gases. These properties enable design of packages which need to "breathe" or those which require a totally captive atmosphere.

Inertness. Because of their excellent chemical resistance, plastics are utilized as the product contact surface with coated packaging materials as well as in an all-plastic package. Similar to glass, plastics do not react with most foodstuffs to impart taste or odor, and they protect other materials on which they are coated.

Safety. Plastics packages do not shatter and rarely break when dropped, a safety feature which was paramount when plastics replaced glass for shampoo, bleach, and beverage bottles. The edges of broken plastics containers are not sharp or hard enough to cause injury.

Transparency. Most plastics are transparent when in the form of thin films, but some are only translucent or opaque in thicker sections such as bottles. When product visibility is important, PET, PVC, polystyrene and polycarbonate are clearly as transparent as glass. Plastics surpass paper and metals in transparency.

Permanence. Except for a few specialty polymers, plastics are resistant to attack by microbes and moisture. This property, along with chemical resistance, make plastics useful in hostile warm and humid environments. Military, construction, transportation, and communications uses of plastics require permanence as do many packaging applications. Plastics do not deteriorate unless exposed to high temperatures or intense ultra violet light. Factors affecting the degradation of plastics will be discussed later.

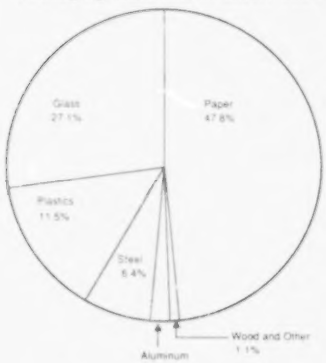
Versatility. Plastics can be tailor-made to offer a broad versatility of design and functionality for packaging. Some are rigid and can support loads, some are flexible for squeeze bottles, some can be stretched, some are sterilizable, and some provide insulation in the form of foams.

Cost Effectiveness. In reviewing the key properties of plastics which have lead to their wide-spread use, performance and cost, or more correctly total economics of use, are very important. Like other applications, a plastics package cannot survive in the marketplace if it is not more cost effective than a rival. Although a plastic material may be more expensive than its non-plastics counterpart, combinations of the superior properties summarized above can result in more cost effective packaging systems.

PLASTICS IN MUNICIPAL SOLID WASTE

An analysis of municipal solid waste (MSW) discarded in 1984, performed for the U.S. Environmental Protection Agency, shows that 32.7 percent by weight of the 133 million tons was packaging materials (2). This percentage has declined slightly since the mid-1960s, probably because lighter packaging materials like plastics have replaced heavier ones such as glass. In 1984, the packaging portion consisted of materials as shown in the following figure:

Packaging Materials in MSW, 1984



Source: Franklin Associates, Ltd., September 1986

Total discarded plastics to MSW in 1984, including plastics from packaging, appliances, housewares, etc., were estimated to be 9.6 million tons or 7.2 percent of the total. These estimates are for net discards and do not include materials which were recovered or recycled.

The same study (2) estimated that in 1984, 95 percent of MSW was landfilled and only 5 percent was incinerated. The portion of MSW disposed of by incineration is projected to grow to 30 percent to 40 percent by the end of the century (3). The incentives for the growth of incineration are the recovery of energy from discarded resources and a rapidly diminishing number of acceptable landfill sites.

Presently, MSW being placed in landfills consists of nearly 30 percent inorganics and plastics (2) which are not biodegradable and, therefore, will occupy some of the volume for a very long time, and about 70 percent organics (not including plastics) which may degrade over varying lengths of time. Some fills have reportedly completed decomposition in three to four years while others have continued decomposing for over twenty years (4). "Glass, plastic, and aluminum refuse in a fill will remain relatively unaltered for twenty years and, depending on the moisture content, paper products may also remain intact for that length of time. Steel, most woods, cloth, and organic wastes will be partially to totally decomposed within 20 years." (4) Decomposition of MSW does not occur completely or rapidly enough to permit re-use of landfill sites for disposal of more MSW.

Plastics pose no unusual problems in landfills. Like ceramics and glass, the plastics do not biodegrade or decompose in the dark oxygen-free environment of a landfill.

Almost 80 percent of the MSW in the U.S., including the 7.2 percent plastics, can be burned to generate energy. The fuel value of the waste is near 4,500 Btu/pound, similar to wood. Plastics provide the richest source of energy on a weight basis in MSW. For example, polyethylene generates over 18,000 Btu/pound, similar to petroleum products from which it was made.

Although there are 74 modern energy-from-MSW plants operating nationwide, the U.S. is far behind many developed countries in the use of MSW as a source of energy (5). Japan now burns 70 percent of its waste and more than half of the wastes in Sweden and Switzerland are burned to generate steam, hot water, or electricity. Waste-to-energy incineration systems can make a valuable contribution to alleviating the landfill crisis. The residue from incineration occupies one-tenth the volume of the original MSW.

Another way to reduce the quantity of discards is to recycle them. Paper is the most recycled material; however, more than 70 percent of discarded paper becomes solid waste. Industrial plastics wastes are recycled at a high level, but post-consumer plastics products are recycled to a very modest extent. Some polyethylene bottles are being recycled to make products including plastic lumber and traffic cones, but the quantity is very small. The most notable recycling of plastics is the soft drink bottle made of polyethylene terephthalate or PET. In 1984, 800 million of these bottles, equal to 20 percent of the bottles produced, were recycled (6). This eliminated 100 million pounds of plastic discards.

The plastics industry along with bottlers, packaging manufacturers, and state and federal organizations, are funding work through the Plastics Recycling Foundation. The Foundation is sponsoring development of technology to permit and promote the recycling of plastics.

LITTER

Some single-use articles, primarily packaging, are disposed of improperly and become litter. Anti-littering laws and valiant efforts by organizations such as Keep America Beautiful have only reduced but not eliminated littering. Once primarily a problem on land, litter also has become a problem in the world's lakes and in the oceans. Aesthetics and protection of wildlife are the driving forces behind efforts to eliminate litter.

Unsightly litter is an old problem, whereas harm to wildlife is a more recent concern. Birds, mainly water fowl and sea birds, have been found entangled in discarded fishing lines and plastic loop carriers. Birds also may eat small plastic articles and plastic pellets causing blockage of their digestive systems and eventually, starvation. Floating plastic bags have been found in the stomachs of sea turtles which apparently mistook the bags for jelly fish. Sea lions have become ensnared in discarded cargo strapping now made mostly of plastic. Lost or discarded fishing gear, such as gill nets, may continue to entrap sea life below the surface. In addition, carelessly discarded infant diapers lined with plastic are unsightly on land or water and, because of improper disposal and incomplete sewage treatment practices, feminine hygiene plastic tampon applicators are found in rivers or on beaches.

One frequently offered suggestion to solve our litter problems is to make the littered items of materials which will deteriorate or degrade at the end of their useful life. However, of the usual packaging materials found in the littered environment, glass is not degradable; aluminum, like plastics, degrades very slowly; steel cans may rust to disintegration; and paper may decompose over time.

Environmental conditions are very important. Steel will not rust if kept dry and away from oxygen, and paper will not decompose unless moist.

Very visible plastics litter has received much attention from legislators, regulators, and the public. These voices are mandating or encouraging that plastics be made more degradable to make them disappear not only from litter, but also from landfills. Presently, 11 states require that plastic loop carriers be degradable, and Federal legislation has been proposed to extend that requirement to the national level. Other proposed Federal legislation would require that the EPA study the effects of plastics dumped on land or in the water.

DEGRADABILITY

Plastics are not inherently biodegradable and scientists historically have sought ways to make them more resistant to other kinds of degradation. Early environmental awareness in the 1960s fostered research to make plastics more degradable. A number of methods were discovered which accelerated photodegradation and have been adopted commercially on a limited scale.

While these plastics used for packaging are not inherently biodegradable, they are susceptible to ultra violet (UV) light or photodegradation. If they photodegrade to small enough molecules, they may be susceptible to biodegradation. Some specialty plastics, such as those used in surgical sutures, are biodegradable and scientists have researched ways to make packaging plastics biodegradable. Two such approaches, one using degradable fillers and the other a new polymer, will be discussed later.

Materials deteriorate or degrade via physical, chemical, and biological actions. They may be physically stressed, chemically

attacked, or consumed by mirobes. All three of these actions have been studied in efforts to accelerate photodegradation or to impart biodegradation in plastics, the two kinds of degradation suggested for removal of plastics products from litter or solid waste.

Photodegradation is degradation resulting from exposure to light. In the case of plastics polymers, photodegradation results from the UV portion of the spectrum, the erythmal radiation which also causes sunburn of the skin. This is the visible portion of the sun's rays with wavelengths in a narrow range between 290 and 320 nanometers (nm) (7)(8). These wavelengths do not appreciably penetrate window glass, but do possess energy sufficient to attack polymer molecules. They are not present to an appreciable extent in artificial light (9). Attack of the molecules may be by UV energy alone or may require the presence of oxygen, in which case, the process is called photooxidative degradation.

Plastics owe their toughness and integrity to their molecular structure which consists of large, usually very long chain molecules. If these large molecules are reduced in size, the plastic article loses strength, becomes brittle, and may fail apart if stressed. UV radiation can cause a chemical reaction resulting in chain scission of the long polymer chains, and physical stress from wind or weight may break it apart. Molecular modification and the use of photo-sensitive additives have both been shown to accelerate photodegradation. Much of the work has been limited to laboratory data, but a few commercial uses have evolved, namely the loop carrier, agricultural mulch films, and more recently, trash bags.

Biodegradation is the assimilation or consumption of substances by living organisms. It can include destruction by rodents or other macroscopic life forms, but when applied to waste it includes only microorganisms such as bacteria and fungi. Biodegradation is catalyzed by enzymes and its rate depends greatly upon environmental conditions such as temperature, moisture, oxygen, and a population of suitable microorganisms. These microorganisms secrete enzymes which require a very moist environment to reach the food source. With plastics, the enzyme must breakdown the polymer molecules to products small enough to be assimilated by the microorganisms for digestion (10). While natural polymers like starch are biodegradable, most synthetic ones are not. Some exceptions will be discussed later. New strains of microorganisms are continually evolving by mutation and natural selection processes, but thus far none have evolved which will consume synthetic, water-resistant, high molecular weight polymers.

Except for the loop carriers, packaging has not employed materials modified for accelerated degradability. In opposition to those who would encourage degradability, there are those who question its true value because of the following: biodegradation is not relevant to the decay of litter because it is a slow process and requires moisture and burial; biodegradation in landfills may have only marginal benefit since it does not remove all materials or even all biodegradable materials in a reasonable time; and while photodegradation may have limited value in reducing litter, it is not relevant to landfills because of the lack of UV radiation.

Two commonly expressed concerns about degradable plastics are possible premature failure of the package and the possible contamination of the contents. In addition to the need for a known and controllable lifetime, the following are important considerations if a modified degradable plastic is to be used for packaging:

1. Provide acceptable performance.
2. Utilize conventional manufacturing technology.
3. Present acceptable economics.
4. Not adulterate the contents.
5. Its degradation products should not be toxic.
6. Be resistant to microorganisms in use.
7. Be disposable with conventional technology.
8. Will not be recycled.

Items 1 through 3 above are particularly critical to the successful commercialization of a modified material. A package will not be acceptable if it does not perform its intended function of delivering and protecting the contents. Unmodified plastics for packaging have been thoroughly characterized regarding barrier properties, inertness to the packaged product, non-adulteration of contents (especially foodstuffs), printability, and other properties; modified resins and the effect of additives to promote degradability will have to be subjected to the same thorough characterization. Package manufacturing technology has been developed with unmodified resins and may need to be itself modified to operate with new materials. The procedure of evaluating and qualifying changed plastics in product manufacture and performance is costly and time consuming.

POLYMER PHOTODEGRADATION TECHNOLOGY

Very pure polymers are not sensitive to that portion of the sun's UV radiation which reaches the earth, namely wavelengths of 280 to 400 nm. As a result, very pure polymers are not susceptible to photodegradation (9,11). In real life, however, plastics articles contain some molecular alterations or imperfections created during processing and fabrication. In polyethylene, thermal processing results in some carbonyl impurity which does absorb UV light from the sun. For greater sensitivity, photo-sensitive additives might be used. It is this susceptibility of impurities and additives to UV absorption, leading to polymer degradation, which forms the basis for the systems which have been offered commercially. A discussion of these systems follows.

Ketone Carbonyl. Carbonyl groups absorb UV energy in the range of 270 to 360 nm (12). If the pure polymer molecule is modified by introducing carbonyl groups (simply, a carbon monoxide molecule) it can be made photo-sensitive to UV radiation reaching the earth. With carbonyl molecules distributed at intervals along the long polymer chain, it can be postulated that UV energy could break the chain at each carbonyl and make the polymer brittle. One method of such molecular alteration has been described by Guillet (9). Guillet introduces carbonyl by incorporating ketone molecules which contain a carbonyl group into the polymer chain. The ketones used absorb UV energy to 330 nm. This range of wavelengths is not present in incandescent light, only barely in fluorescent light, but appreciably in the sun's rays. Window glass screens most of this range of wavelengths. Plastics modified by this method should, therefore, not be expected to photodegrade under artificial light or behind window glass.

Guillett's work with the ketone method of introducing carbonyl is more fully described in patents (13). The technology is offered commercially for license and as a masterbatch plastic resin by EcoPlastics, Ltd. of Ontario, Canada. The masterbatch provides a concentrated form of the ketone copolymer to be mixed with a larger quantity of unmodified resin. Presently, only the polyethylene form is being sold, but a polystyrene

version is reported to be available, as well. Material now being sold is used in Europe for trash bags and grocery sacks and is being field tested in agricultural mulch film, some of which is sold in Canada. Use of the masterbatch adds 8 percent to 10 percent to the cost of the film (14).

EcoPlastics reports that their Ecolyte masterbatch modified plastics have physical properties similar to unmodified plastics and that lifetime can be controlled if environmental exposure conditions are known. Food and Drug Administration sanction of Ecolyte plastics for use in contact with foods has not been requested.

Carbon Monoxide Carbonyl. Another method of incorporating carbonyl groups, which is applicable to only low density (not linear low) polyethylene, is to copolymerize carbon monoxide with ethylene in the polymer manufacturing process. The level of carbon monoxide incorporated is typically less than 2 percent. The photodegradation reaction is similar, although not identical, to that with ketones. Again, the polymer chain breaks at the CO groups to form shorter, weaker chains. This method is used by several plastics resin manufacturers, namely, Dow Chemical, DuPont, and Union Carbide Corporation, who offer such resins for sale. These modified polymers have not yet been sanctioned for direct contact with foods by the Food and Drug Administration.

The intensity of UV radiation absorbed by the material determines the rate at which chains will be broken. Thus, a plastic article shaded from the sky will not photodegrade as rapidly as one that is not. Similarly, latitude and the seasons have a substantial effect. Except at lower latitudes, winter time rates will be slower than summer. Articles will degrade more rapidly near the equator than in northern latitudes. A study by Jonas (15) conducted in Oregon, reported embrittlement of plastic loop connectors made from an ethylene-carbon monoxide copolymer to be up to five times faster in the middle of summer than in the fall and winter. These geographic and seasonable variables may present a problem of tailoring the plastic to give an acceptable degradation rate and controlling distribution of packages.

These methods of introducing carbonyl as an integral part of the polymer molecule avoid the potential leaching or loss of additives which may occur with additive systems. Since these carbonyl systems require UV radiation, the degradation process will be retarded if the article is screened from the sun's ray. Unless exposed to the sun for a sufficient length of time to result in gross molecular scission, carbonyl modified plastics will not become biodegradable in a landfill. Potts (16) reported that polyethylene must be broken down to a molecular weight of 500 or less before it will support microorganisms. Polyethylene articles are typically made from polymers having molecular weights of 20,000 or higher.

Additional methods for accelerating photodegradation employ additives, either singly or in combination, which are claimed to be synergistic or to yield chemicals which continue the degradation process in the absence of light.

Ampacet. The Ampacet Corporation of Mt. Vernon, New York, markets a proprietary additive containing masterbatch called "Poly-Grade" for polyolefins. Masterbatch is offered in natural and white or black. White and black are utilized by one manufacturer of trash bags in the U.S., while the natural is sold in Europe (17). Poly-Grade is not FDA-sanctioned for use in contact with foods.

Princeton Polymer Laboratory. This laboratory does not offer masterbatch or resin, but does offer technology and license under a U.S. patent (18). Claimed to be suitable for use in polyolefins and polystyrene, a dual additive system is used for synergism. The dual additives are selected from two classes of chemicals:

1. A photo activating material such as benzothiozol or benzophenone, and
2. A prooxidant, typically a transition metal salt such as zirconium stearate or nickel acetate.

Antioxidant—Photoactivator. During thermal processing, plastics may be degraded by oxygen by the formation of peroxides. To prevent this thermal oxidative degradation, additives known as antioxidants are incorporated in the plastics resin formulation. These antioxidants scavenge the oxygen so it cannot degrade the polymer molecule. Interestingly, some antioxidants containing certain metal salts act to stabilize polyolefins if present at high concentrations, but act as photodegradation catalysts at lower concentrations. Professor Scott (19) stated, "Studies of mechanisms of antioxidant action have led to the development of antioxidants which act by catalytically destroying hydroperoxides during polymer processing and subsequent exposure to ultraviolet light. They are, however, destroyed at the end of the photooxidation induction period and subsequently catalyze the photodegradation process."

Scott's antioxidant-photoactivator system was further refined in conjunction with Gilead as described in two recent pateats (20). The improvement utilized a two-additive system, one being a complex of iron which is a peroxide decomposing antioxidant, and UV stabilizing compound. A typical compound is ferric dibutyldithiocarbamate. The second is a metal ion deactivating compound which also acts as a photostabilizer. Nickel or cobalt complexes such as cobalt dibutyldithiocarbamate are suggested. It is claimed that by varying the relative amounts of the iron complex versus the cobalt or nickel complex, the lifetime of the plastic article, such as film, can be controlled providing the amount of UV exposure is known.

In practice, UV energy is absorbed by the metal complexes, thus releasing the metal ions which then act as catalysts to break the polymer chains. It is claimed that this breaking of polymer chains will continue in the absence of sunlight or oxygen (21).

Polyethylene films, primarily for agricultural mulch using this technology, are offered in the U.S. by Ideamasters, Inc. of Miami, Florida, under the tradename PLASTIGONE. This technology does not apply to other than the polyolefins. Although only films are presently marketed, the company may supply masterbatch in the future (24). Food and Drug Administration sanction for use in contact with foods has not been requested.

POLYMER BIODEGRADATION TECHNOLOGY

Efforts to make plastics biodegradable have pursued two courses, one to make the polymer itself susceptible to enzyme attack, and the other to incorporate biodegradable additives. The second approach does not necessarily make the polymer biodegradable.

An extensive study and review by Potts (7) revealed that some synthetic polymers do support microbial growth. Such polymers include some aliphatic polyesters, polyester diol based

polyurethanes, and polylactides made from lactic acid. These three classes of polymers do not possess properties necessary for packaging materials, but have found use in some specialty applications where biodegradability is desirable. Polycaprolactone, an aliphatic polyester, has been used to make seeding pots for automated reforestation planting. Polylactides and polyglycolate, also an aliphatic polyester, have been used for degradable surgical sutures and devices. To date, biodegradable polymers possessing properties and economics suitable for packaging applications have not been developed. Enzymes do not attack these high molecular weight polymers but do catalyze the biodegradation of low molecular weight fragments inherent in most synthetic plastics or produced by aggressive photo or oxidative degradation.

One recent development of aliphbatic polyesters claims a polymer which is biodegradable and possesses properties similar to some polyolefins. Other attempts to impart biodegradability to polyolefins utilize starch as a filler.

PHBV—Biodegradable Plastic. PHBV is an acronym for poly (hydroxybutyrate-valerate). These are aliphatic polyester copolymers produced during fermentation of sugars. Their existence has been known for more than 50 years, but extraction and purification from fermentation bacteria has only recently been perfected. Holmes (23) states that these polymers are biodegradable and resemble polypropylene in properties.

PHBV is marketed by Marlborough Biopolymers, Ltd. (MBL), a subsidiary of ICI in England. MBL is producing the polymer in ton quantities in the U.K. for applications development work in surgical devices, personal hygiene products, and packaging. Medical grade material is expensive, but less pure material "with properties intermediate between polypropylene and PVC can be extracted using more basic technology." The rate of biodegradation depends upon form and environment, but is reported to range from several days for a film in anaerobic effluent to nine months for a bottle in soil.

Starch—U.S. Department of Agriculture. Research at laboratories of the USDA has discovered technology for the incorporation of gelatinized starch in copolymers of ethylene and acrylic acid (EAA) and polyethylene. The method is described by Otey (24,25) and in U.S. patents (26). This combines a natural biodegradable polymer, starch, with a synthetic nonbiodegradable polymer. Compositions containing up to 60 percent starch have been made into blown films using small laboratory equipment. As the starch level is increased, the physical properties of films decreases. Starch levels of 40 percent or more demonstrated mold growth associated with biodegradability in laboratory tests. Field studies have not been conducted. It is expected that microorganisms will consume the starch particles leaving a porous plastic article which may disintegrate or deteriorate so it, too, may become biodegradable.

Preparation of film requires the mixing of starch, water, and EAA copolymer with the addition of a base such as ammonia. Polyethylene may be added to this mixture, but the EAA is essential for compatibility. This mixture may then be extruded into a blown film.

This technology recently (1986) has been licensed by Agri-Tech Industries of Gibson City, Illinois. Agri-Tech will use facilities of the business development unit at the University of Illinois to do development and pilot plant scale-up of the technology, possibly leading to a venture which would supply resins (27).

Starch—St. Lawrence ECOSTAR. Other technology for the use of starch as a biodegradable filler in plastics was reported by Griffin (28). Griffin claimed the addition of an autooxidant would degrade the synthetic polymer if buried. This technology was commercialized in the U.K. by Colorall, Ltd. for use in grocery sacks. Subsequently, the worldwide rights to the patents (29) have been acquired by the St. Lawrence Starch Company, Ltd. of Ontario, Canada, which offers a masterbatch presently for only polyethylene. Masterbatch for other plastics may be offered in the future.

The technology utilizes starch which is treated with a silane coupling agent to provide compatibility with the synthetic polymer, such as polyethylene. To this is added a small amount of an unsaturated ester, such as corn oil, to serve as the autooxidant. In a buried article made of this mixture, the starch is consumed by soil fungi leaving a porous structure, while the corn oil reacts with metal salts in the soil to form peroxides. Allegedly, the peroxides break the synthetic polymer chains into fragments small enough so that they too can be biodegraded. Following burial, a polyethylene film containing 15 percent starch decomposes in six months and one with 6 percent starch in three to five years (30).

A polyethylene masterbatch containing 60 percent starch plus corn oil and desicant sells for about double the price of polyethylene. There is no commercial use of ECOSTAR in the U.S., but a Canadian company is planning to use it for trash bags. St. Lawrence is preparing to utilize ECOSTAR in polyethylene bottles for corn oil and syrup in Canada and is awaiting approval from the Department of Health and Welfare. Compliance with U.S. FDA regulations has not been investigated.

The molecular modification and additive systems described above have been demonstrated and are presently used commercially only with polyethylene. The applicability or effectiveness of such systems has not been demonstrated in most of the other plastics used for packaging.

CONCLUSION

Some of the methods reviewed above have been available for more than 15 years, but have found very limited applicability, particularly in packaging. They have been used where degradability serves a useful purpose such as in surgical sutures, agricultural mulch film, and loop carriers, or where they provide a marketing uniqueness as in trash bags and grocery sacks. Loop carriers are a special case since their physical configuration may entrap wildlife.

Manufacturers and users of plastics packaging point out that only a small percentage of items are littered, and since it is not known which specific item will become litter, they ask why all should be faced with the added cost. Why, for example, they ask, should plastic beverage bottles be made degradable when only a minor portion are littered and degradability would not only add cost but also preclude recycling? Why, in fact, they ask, must plastics be degradable when glass and metal containers are not? Similar reasoning may be applied to all packaging, the large majority of which is collected for proper disposal where degradability provides no benefit for incineration and is of questionable value in landfill.

Degradability could be beneficial for those items discarded on the oceans; however, the methods described above have not been shown to be effective in the submerged marine environment. If degradability in the sea were possible, the distribution system would have to be controlled so as to not

penalize items disposed on land with the added cost. Degradability would be most cost effective if it could be applied selectively to only those items where it provides a benefit.

Synthetic polymers presently used for packaging plastics are not biodegradable and unless modified, degrade only slowly in sunlight. Following is a list of factors which must be taken into account when considering whether plastics can, and should, be made degradable for given applications.

1. Methods to accelerate degradability of plastics are mostly untried in critical applications with generally uncontrolled environmental exposure such as packaging. It is not known if these modified plastics will satisfy the requirements of the Food and Drug Administration.
2. Photodegradability is relevant only to litter and depends upon exposure to UV radiation.
3. Biodegradability is relevant only to landfill since burial and moisture are required. It has questionable value because the process is slow and the landfill will not be returned to use in a reasonable time.
4. All things must go somewhere. Unmodified plastics do not degrade. Degradation products of degradable materials are not well characterized, so their toxicity and environmental effects are unknown.
5. Plastics modified to be degradable will cost more. As specialty materials, they will require separate handling and lose the economy of scale.
6. Additional costs will be incurred because of restrictions on distribution. Photodegradable articles for northern latitudes may need to be different from those shipped to southern latitudes. Seasonal differences also may need to be considered.
7. Performance must be characterized and use controlled to prevent premature failure of the package which could lead to product loss or product contamination.
8. Materials which degrade become a lost resource. Degrading plastics may eventually return carbon to the carbon cycle but incineration is a quicker method of accomplishing this with the added benefit of energy recovery.
9. Plastics articles modified for accelerated degradability will not be recycled since their remaining life would be unknown. They may, in fact, impede recycling since some modified material accidentally mixed with nonmodified would introduce the degradability trigger into the entire mix.
10. The impression that an article is degradable might result in more litter.

The technology to make some plastics photodegradable and/or biodegradable has been demonstrated and commercialized in a few applications. Degradability can be beneficial and cost effective if it is applied selectively, but for most applications degradability is undesirable. For each plastics application, one must ask—is degradability beneficial?—particularly in light of the factors summarized above.

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This paper was developed by SPI's Ad Hoc Committee on Degradable Plastics. It was presented by Regina Johnson, Dow Chemical Corp., at the SPI Symposium on Degradable Plastics on June 10, 1987 in Washington, D.C.

Mr. STROMBERG. On behalf of the American Association of Port Authorities, I appreciate the opportunity to testify today. AAPA shares your concern for solving the serious pollution problem that is the subject of today's hearing.

By way of background, AAPA represents virtually all of the public port authorities in the United States as well as the major port agencies in Canada, Latin America and the nations of the Caribbean Sea. AAPA members are, without exception, public entities which own marine terminals and other facilities necessary for the conduct of waterborne commerce.

I should point out that in most U.S. harbor areas there are many privately owned terminals outside of our jurisdiction.

Mr. Chairman, because plastics pollution is an international problem, we believe it needs an international solution, and we support the implementation of Annex V as the best available means of curtailing harmful waste disposal in the ocean. Outlawing the disposal of plastics at sea with sanctions for failure to comply should provide the necessary incentives for limiting the use of such materials in vessel operations as well as enhancing the existing market for disposal services.

In general, we believe that improved handling of waste on board vessels will lead to the most effective and efficient means of shoreside disposal.

In addition, any legislated solution should be flexible to take into consideration the wide range of local circumstances and conditions and should not, we believe, rigidly mandate public port authorities to be directly responsible for the construction and operation of shoreside facilities. Public port authorities are prepared to continue our efforts to work with local and state governments to assure the provision of the shoreside facilities required under Annex V as we have under Annexes I and II.

Upon implementation of Annex V, there are expectations of an increased demand for waste disposal services in port, but there is no guarantee that this will, in fact, be the case. For example, reception facilities for uncontaminated trash, plastics and dunnage are now generally available.

There is, however, a complicating factor for garbage of foreign origin regulated by the U.S. Department of Agriculture, as has been mentioned. The potential problem lies in the availability of APHIS-approved reception facilities in every port and harbor area and will be made more severe if there are significant volumes of trash, especially plastics, that are contaminated by regulated garbage.

I should note, however, that under Annex V biodegradable garbage and trash may be dumped offshore at specified distances, which will likely continue to prove to be a feasible and appropriate option to the vessel operator and which will likely diminish the potential demand for APHIS-approved shoreside disposal facilities.

In order to assess the existing availability of waste disposal facilities in our ports, we surveyed our membership. The results of our survey indicate that approximately 60 percent of AAPA U.S. members have facilities which are capable of handling regulated waste available in or around their port areas. At least 70 percent of these facilities are located within 10 miles of the port.

The provision of various services required by ships in port is currently handled either by the ship's agent or by the local office of the steamship line. Included in the services provided are the arrangements for ship waste removal.

In our survey, 80 percent of the port authorities responding indicated that they expect these services to continue to be provided entirely by third parties other than the terminal operator. Twenty percent said that the port authority may play some type of coordinating role but again did not see themselves involved financially or operationally.

Among the 40 percent of our members that do not presently have APHIS-approved capability are a few of the larger port areas in the country; but the majority of public port authorities without available facilities are our smaller members with limited financial resources. In some cases, especially in the more urban areas without facilities, efforts are already under way to build an incinerator in proximity to the port.

Given these circumstances and the fact that it can be extremely difficult to site and obtain permits for an incinerator, we believe the Coast Guard should have as much flexibility as possible to enforce the law and to give needed consideration to each individual situation.

In conclusion, Mr. Chairman, I believe that implementation of Annex V regulations will likely stimulate efficient solutions to the plastics disposal problem, just as the enforcement of Annex I led to advances in the management and disposal of oily waste. If ship operators can keep their plastic separated from material that is of concern to the U.S. Department of Agriculture, port authorities and terminal operators should not have major problems in doing their part in complying with Annex V requirements.

Noncontaminated plastic waste can be disposed of in the same manner as most terminal trash. More importantly, vessel operators will have an incentive to decrease their use of or eliminate nonbiodegradable packaging, since disposal services can be costly.

Finally, private sector waste management companies are now available, as indicated in earlier testimony, in a majority of port areas to transport contaminated waste to an approved facility.

Mr. Chairman, the public port industry recognizes the seriousness of this problem and stands ready to assist the Congress and the Coast Guard to devise the most efficient, cost effective means to dispose of ship waste in each local situation.

Thank you for the opportunity to present our views.

[The statement follows:]

STATEMENT OF ERIK STROMBERG, FOR THE AMERICAN ASSOCIATION OF PORT AUTHORITIES

Good morning Mr. Chairman and distinguished members of the committee. My name is Erik Stromberg. I am president of the American Association of Port Authorities. Thank you for the opportunity to testify today. AAPA shares your concern for solving the serious pollution problem that is the subject of today's hearing.

Organized in 1912, AAPA represents virtually all of the public port authorities in the United States as well as the major port agencies in Canada, Latin America, and the nations of the Caribbean Sea. In general, public port authorities are created by States or local governments to facilitiate international trade and to stimulate economic development in the regions they serve. AAPA-member public port authorites own terminals with deep wate access to the ocean. In some cases, the authority em-

ploys its own work force and operates the terminal. In others, terminals are leased to privately owned terminal operating companies or stevedores. In all harbor areas of the United States, there are many privately owned terminals serving ocean-going vessels that are outside of the port authority's jurisdiction.

Similar to annexes I and II of the treaty, Annex V of the convention for the Prevention of Pollution From Ships (Marpol 73/78) states that "governments of each party to the convention (shall) undertake to ensure the provision of facilities at ports and terminals for the reception of garbage, without causing undue delay to ships." Mr. Chaiman, because plastics pollution is clearly an international problem in need of an international solution, we support the implementation of Annex V as the best available means of curtailing harmful waste disposal in the ocean. Outlawing the disposal of plastics at sea with sanctions with for failure to comply should provide the necessary incentives for the reevaluation of the use of such materials in vessel operations. In general, I believe that improved handling of wastes on board vessels where it is generated will lead to the most effective and efficient means of disposal. In addition, any mandated solution should be flexible enough to take into consideration the wide range of local circumstances and conditions.

Upon implementation of Annex V, one would expect an increased demand for waste disposal services in port, but there is no guarantee that this will be the case. Reception facilities for "uncontaminated" trash, plastics, and dunnage are generally available at U.S. ports. However, there is a complicating factor for garbage of foreign origin being discharged in a United States port. Disposal of garbage containing foreign animal or vegetable matter is regulated by the U.S. Department of Agriculture's Animal and Plant health Inspection Service (APHIS). APHIS requires this matter to be burned in an approved incinerator (one that destroys all organisms), or to be sterilized before being placed into a local landfill. Under Annex V, garbage may be dumped offshore at specified distances, which will likely prove to be a feasible and appropriate option to the vessel operator, and which will likely diminish the demand for APHIS-approved disposal facilities. The problem, in terms of the availablility of such APHIS-approved reception facilities, will be made more acute if there are significant volumes of trash, especially plastics, that are "contaminated' by APHIS-regulated garbage and presented at the port for disposal.

In order to assess the existing availability of waster disposal facilities near ports, we surveyed our membership. The primary information sought was the availability of facilities for disposing APHIS-regulated waste. The results of our survey indicate that approximately 60 percent of AAPA U.S.-members have facilities which are capable of handling regulated wastes available in their port areas. At least 70 percent of these facilities are located within 10 miles of the port. In addition, seven respondents (7) reported that nearby incinerators could potentially be approved by APHIS.

The provision of various services required by ships in port is currently handled either by the ship's agent or the local office of the steamship line. Included in the services provided are the arrangements for ship waste removal. In our survey, 80 percent of the port authorities responding indicated that they expect these services to continue to be provided entirely by third parties other than the terminal operator. Twenty percent said that the port authority may play some type of coordinating role, but again, did not see themselves involved financially or operationally.

Among the 40 percent of our members that do not presently have APHIS-approved capability are a few of the larger port areas in the country. But, the majority of public port authorities without available facilities are our smaller members with limited financial resources. In some cases, especially in the more urban areas without facilities, efforts are already underway to build an incinerator in proximity to the port. Because of the relatively high cost of purchasing and operating a sterilization facility that would meet APHIS approval, and because most of the ports without nearby facilities are small, the Coast Guard should have as much flexibility as possible to ensure the law is enforced, and to give needed consideration to individual circumstances.

As you know, Mr. Chairman, it can be extremely difficult to site and obtain permits for an incinerator. Local citizens who have been convinced of the safety of a plant may, nevertheless, still oppose a facility that may draw traffic to a community and possibly lower property values. Even where serious plans for a facility have long been underway, the availability of such facilities within a year of the ratification of Annex V or its implementing legislation is uncertain. This is another example of why flexibility is needed. For example, it would be unwise for a port authority or terminal operator to invest in a sterilization device only to have a municipal resource recovery plant come on line shortly thereafter.

Mr. Chairman, I believe creative, common sense solutions that do not necessarily require a huge capital expenditure are available. Implementation of the Annex V

regulations will likely stimulate efficient solutions to the plastics disposal problem, just as the enforcement of Annex I led to advances in the management and disposal of oily wastes. If ship operators can keep their plastics separated from material that is of concern to APHIS, port authorities and teminal operators should not have major problems complying with Annex V requirements. Plastic wastes can be disposed of in the same manner as most terminal trash. More importantly, however, vessel operators will have an incentive to limit or eliminate non-biodegradable packaging from their vessel stores since disposal services are costly. From a regulatory standpoint, it may also be prudent to review APHIS regulations that prohibit the transport of regulated garbage through rural areas. It may be found that with certain strict precautions, such transport can be safe, and might provide the most efficient alternative in some port regions.

In conclusion, Mr. Chairman, our research indicates that private sector waste management companies will be available in the majority of port areas to transport contaminated wastes to an approved facility. Many companies have already shown interest in providing disposal services for waste as required by Annex V. Moreover, as I have mentioned, the ultimate disposal of garbage and trash, especially plastics will be greatly facilitated depending on the nature of the waste received from the vessel and the condition in which it is received at the terminal (that is, whether or not it is contaminated by APHIS-regulated garbage).

What is needed is an educational effort to inform ocean users worldwide about the dangers that plastics pose to the environment and the penalties for violating Annex V's regulations. The public port industry recognizes the seriousness of this problem and stands ready to assist Congress and the Coast Guard to find the most efficient, cost-effective means to dispose of ship wastes in each local situation.

Thank you again for this opportunity to present our views.

Senator BREAUX. Thank you, Mr. Stromberg and all the members of the panel for being with us.

Dr. Brown, with regard to waste management situations, I take it that plastic containers do not present a particular special problem as far as land-based disposal of solid waste. What do you normally do with plastics, for the record, when you have solid waste disposal onshore?

Dr. BROWN. Plastics are routinely landfilled, and they are routinely incinerated in this country.

Senator BREAUX. It does not present a particular problem from a landbased perspective?

Dr. BROWN. No. Of course, what we are talking about is a tiny fraction of the plastics that are generated in the United States and part of the waste stream.

Senator BREAUX. So I guess from the disposal perspective, biodegradable or photodegradable plastics really does not help your industry from the standpoint of disposal on shore?

Dr. BROWN. From the industry's point of view I think that is correct, although we certainly support every effort to make plastics as degradable as we can.

Senator BREAUX. Mr. Freeman, from the plastic industry's perspective, the problem seems to be more limited to the problem of plastics and the marine environment.

Mr. FREEMAN. Well, there have been questions certainly raised about plastics in the waysteam simply because there are more of them and there is a waste problem in the United States now, but with regard to the marine problem degradability is really only relevant to the extent that the plastics, if they are to be photodegradable, are exposed to ultraviolent light for a sufficient period of time or if it is to be biodegradable is exposed to the right combination of microorganisms and wetness.

So it basically addresses the litter aspect and is not a question. Degradability is merely, we feel, a major option to deal with land-based pollution.

Senator BREAUX. Can you predict with any degree of certainty that in a certain time frame we are going to be looking at plastic products that would be degradable after they are used to store materials sufficiently?

Mr. FREEMAN. I wish somebody could, but no, I cannot. When we started putting together this symposium on degradable plastics in January, we put together a task force of industry members which, by the way, still exists, and we expect to continue to draw upon its expertise in the months ahead.

We learned several things. Number one, research on degradable plastics has been going on for at least a quarter of a century or more, and there are, as noted in the proceedings of our symposium, some of which are attached to my testimony, some limited commercial applications; but the going is slow for several reasons.

Number one, by making a plastic degradable you are either adding a molecule or taking it away, and you are changing the way that plastic will perform and compromising in some way, perhaps, its performance. We do not understand enough about degradable plastics to suddenly just make them degradable like that. As I said in my oral testimony as well as my written, we know even less right now about what happens to plastics after they degrade. In fact, we know as a society much less than I think we should about what happens to materials generally when they degrade, paper included.

Senator BREAUX. Dr. Brown?

Dr. BROWN. Just a couple of additional comments.

On the degradability, I think it is important to realize that there are certain commodities, like six pack holders for beer, where there is nothing inconsistent with degradability and the basic purpose of the plastic commodity.

There are uses of plastics, like nets and containers for caustic materials, for example, where it is probably inconsistent with the real value of the plastic to have it made degradable.

So, number one, I just think it is realistic to assume we will in some areas have degradable plastics but in other areas probably not.

The other thing concerns your earlier question. The broader question of plastics in our society and whether they should be landfilled or whether they should be managed in some other way is, I think, a tougher question than the one that is before the committee today.

We should recycle plastics as much as we can. Waste management, for example, is planning on recycling household plastics in San Jose, California in the next several months, and hope to do that more with city waste.

But what we are talking about here is balancing: on one hand is the failure to have degradable plastics or recycled plastics and the less desirable straight landfilling of those things, which nevertheless can be done in a way that poses no significant environmental threat.

That is balanced against the real threat, an acute threat, of throwing it into the ocean and having it be eaten by these creatures or entangling them. There is no real question, I think, that you can landfill them; and, in fact, that landfilling is far better from the environmental point of view than tossing them into the sea.

Senator BREAUX. Senator Bentsen, questions?

Senator BENTSEN. Thank you.

Mr. Cox, what percentage of the vessels that you represent carry incinerators?

Mr. Cox. I am sorry, was that incinerators?

Senator BENTSEN. Yes, incinerators.

Mr. Cox. We have not done a specific study on what types of equipment are aboard the vessels, but in talking with our owners there are incinerators on ships now, and the last five American ships have been built with incinerators. All the companies are certainly researching placing incinerators on existing ships.

Senator BENTSEN. Do you think the move will be to go to incinerators on the ships, or do you think, in compliance with Annex V, that they will take their plastic trash ashore?

Mr. Cox. I think the answer is both, Senator. It depends on the ship's operation. I think if it is out at sea for a relatively short period of time, a week or so, that the ship can then avail itself of a shoreside reception facility.

If it is going to be out at sea for a longer period of time or on an international voyage where maybe another nation does not provide reception facilities, then the ship is going to have to comply somehow, and I think it is in that scenario that they are thinking about incinerators aboard the vessel.

Senator BENTSEN. Let me ask you about a practical problem. Looking at Annex V, if you have packing cases and the lining for them, which I suppose is subject to floating, as I understand it they have a right to take that 25 miles offshore and dump it if they want to, and I would assume that a lot of that is generated right there at the port.

As a practical matter, what would a captain do? Would he try to dispose of it right there at the port, or would he take it offshore where you can just dump it?

Mr. Cox. I think, as a background to explaining my answer, for example, where a vessel is carrying cargo from point A to point B, our normal method of operation in the dry cargo side is to try to present the cargo to the consignee in the same condition in which we got it. So the actual cargo containers and the wrappings we try to keep intact.

To the extent that goods are delivered aboard a ship to where we would uncrate them ourselvess then that would be a trash problem which the ship would have to handle. But I think from the cargo side, most of the generation of the trash is in a shoreside environment when you are in port, and it then becomes a stevedore responsibility to get rid of the particular dunnage.

Now, in the past, it has been my experience as a seagoing officer, that we have carried dunnage to sea and discharged it at sea. Now, that dunnage was mainly wooden material, but I think under Annex V, even though it would be permitted, it might be better

public relations for the company to contract with the stevedore to take that material ashore.

Senator BENTSEN. Dr. Brown, looking at enforcement of this, you want to have a lead agency. Would you comment again on what you think the lead agency should be in the way of the management of this garbage?

Dr. BROWN. I would not want to suggest that the Coast Guard should not have overall oversight responsibility and probably perhaps the lead role in promulgation of regulations under MARPOL Annex V—as it has currently under the other MARPOL annexes. But with respect to inspection and enforcement, it does seem to me that the APHIS bureau of Agriculture is probably the logical lead, in coordination with the Coast Guard.

The reason simply is that APHIS, by it's own statements, inspects at least 60 percent of the vessels that bring foreign garbage here. They consider that a high priority. In fact, APHIS operates differently from the enforcement programs of a number of agencies, where spot checks are made, the idea being that there is some deterrence because people are afraid they are going to be caught. Agriculture is afraid that that one contaminated apple is going to end up getting eaten by a pig and cause $6 billion worth of damage to the agricultural industry.

So they are quite intensive, I think, in their inspection. They are on the vessels, and presumably it would be relatively simple for them to extend that to review of the logs, for example, so that Agriculture would not only get there to check out the foreign trash but to review the logs.

Because of their other responsibilities, I presume that APHIS understands things more intuitively about the nature of the garbage trade than does the Coast Guard, I doubt, has that same kind of expertise.

So I would suggest that they should have what amounts to a lead role there, and I think it would save the taxpayers' money because Agriculture is going to be there to try to keep these infectious diseases out whether or not the Coast Guard is there. Why not save the taxpayers dollars and have Agriculture do it all.

Senator BENTSEN. Pigs are a little bit like people. They will eat anything.

Dr. BROWN. Senator Bentsen, I have also worked with APHIS in the past when I was managing some endangered species activities for the government. APHIS was a reluctant partner in endangered species conservation for plants. Much the same thing that might happen here happened then, because their fundamental job was to stop those foreign diseases from getting in on plants, and it still is.

They were reluctant to have another role which was to protect the plants and to make sure that we did not trade in them. Yet, they now accept the dual role, and I think it would work here too.

Senator BENTSEN. Mr. Stromberg, Annex V talks about having reception facilities for handling trash from the vessels at the port and the terminals. Yet, as I listen to you, you seem to have the port authorities in a minimal role in this process.

Who has the responsibility, then?

Mr. STROMBERG. Our view would be that the person responsible for generating the trash would have the responsibility for its ultimate treatment and disposal.

Senator BENTSEN. Here is a fellow that comes in there maybe infrequently to a particular port and has to dispose of it, and he has to look at some permanent facility. So you have to have somebody locally in charge of that situation.

Mr. STROMBERG. Some of our ports, in fact, have accepted this responsibility where, in working with the local communities, there were no other facilities available, and in fact have gone out and constructed these facilities.

In the Annex I situation where we deal with oily waste, our responsibility is to insure that waste handlers are available and that facilities are adequate to treat the removal of the oily waste from the vessels. A comparable responsibility, I think, is appropriate under Annex V.

Our concern is that if we are required to take a specific role in constructing facilities, there may be duplications of facilities. There may be better ways. Disposal may require travel to a more distant facility that might be appropriate rather than putting it immediately at the terminal area.

So I think the ports in general are willing to work with the Federal agencies. Our overall interest is to expedite the movement of the vessels and the cargo through our piers. We need the flexibility under Annex V to allow facility construction either on port property or wherever it seems to be appropriate and efficient to locate.

Senator BENTSEN. Mr. Chairman, there seems to be a unanimity of concern and support. I wish we could go to the third reading, but I guess we cannot today.

Well, I thank the Senator and the panel for presenting their testimony. I think there is one thing that has become very clear, and that is the recognition of the severity of the problem and the fact that something needs to be done.

The recommendations for moving forward with Annex V I think are very clear.

Also with regard to implementing legislation which would be needed, I think the record is quite clear that we need to move aggressively in all these areas. All of our witnesses today I think have been quite clear on that.

This will conclude the subcommittee's hearing, and the subcommittee will now stand in recess until further call of the Chair.

[Whereupon, at 12:25 p.m., the hearing adjourned.]

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

STATEMENT OF HON. JOHN H. CHAFEE, U.S. SENATOR FROM RHODE ISLAND

Mr. Chairman and members of the committee. Thank you for the opportunity to address you today on a treaty provision which, if enacted, could result in a significant decrease in the amount of plastic being dumped in our oceans.

During the 99th Congress, I introduced a bill to address the serious problem of plastic pollution in the marine environment. My reasons for introducing this legislation are painfully apparent to anyone who frequents our beaches, and I am not just referring to the beaches in my own State of Rhode Island. On this point I would like to read you part of a story which appeared July 10 on the front page of the New York Times. The article is titled, "Invasion of Trash From the Sea Overwhelming Coastal States."

"This morning's tide swept a bountiful harvest from the sea over Bolivar's beach in Texas: faded plastic bags, tangled ropes, rubber gloves, egg cartons, thousands of six-packs and soda cans, a plastic container of 'Milde shampoo' from the Netherlands and a rusty refrigerator.

"Almost all of it was refuse dumped from ships at sea . . . while many States and localities struggle to find places to put their own garbage, coastal States from Rhode Island to Texas to Alaska are coping with tons of seaborne trash from merchant freighters, fishing vessels and even Navy and Coast Guard ships . . .

"The overall problem has led to growing complaints by beachgoers on the Atlantic, Gulf and Pacific coasts, where even remote pristine beaches are routinely fouled, and where local cleanup costs are growing . . . The consequences are more than esthetic for the millions of waterfowl and marine animals that each year strangle themselves on plastic debris or choke to death after swallowing plastic pellets or bags. The yokes that hold together beverage sixpacks are said to be a particular menace . . ."

This article is typical of others which have appeared during the last two years, and points to a public who are increasingly angry about litter on their beaches, and concerned about the unnecessary death of marine creatures. I recently chaired a Senate hearing on plastic pollution in Rhode Island, and heard from several witnesses about the tons of pollution which foul our beaches annually. Within the last month I have heard back from over 500 of my constituents, urging me to take steps to address the problem of plastic pollution.

Early in this session of Congress I reintroduced my bill, the Plastic Waste Reduction Act, and also introduced legislation to implement the provisions of Annex V of the International Convention for the Prevention of Pollution from ships, also known as MARPOL, and the subject of this hearing. I plan to amend my bill to incorporate proposed legislation drafted by the United States Coast Guard and supported by the administration. My bill will strictly implement the provisions of MARPOL by amending the act to prevent pollution from ships (APPS).

According to an EPA study, most of the plastic in the marine environment comes from ocean sources. That amount is estimated at 6.4 million metric tons per year. While accidental loss of plastic items from ocean vessels and on beaches contributes to the problem of debris, deliberate disposal at sea is a greater problem.

As you are aware, in order for Annex V of MARPOL to enter into force the treaty must be ratified by nations representing at least 50 percent of the worlds shipping tonnage. Just last week the Soviet Union announced that it has ratified Annex V, becoming the 28th nation to do so. This creates an opportunity for the United States. If, as is my hope, the Senate approves a resolution of advice and consent for Annex V, nations representing more than 50 percent of the worlds shipping tonnage will have ratified the treaty, and it will have the force of international law.

Before I conclude, let me tell you about a group of sailors I met recently in Newport, Rhode Island, who had completed a single-handed sailboat race around the world. These sailors stored all their plastic garbage on board, despite the inconvenience it caused them, until it could be properly disposed of on shore. I asked these sailors if they had encountered a great deal of plastic debris on their journey. Without hesitation they responded that indeed they had seen enormous amounts of plastic strewn across every ocean, and becoming more concentrated at the coasts.

The Senate Environment and Public Works Committee will be considering my plastic legislation, and related legislation introduced by my distinguished colleague, Senator Lautenberg, at a hearing this September. At that time we will focus on how best to implement the provisions of MARPOL Annex V.

It is high time that we stop using the ocean as a collective garbage dump for non-degradable materials. Thank you for the opportunity to address this committee today.

STATEMENT OF RONALD K. DEARBORN, UNIVERSITY OF ALASKA AT FAIRBANKS

Thank you, Mr. Chairman, for the opportunity to submit this testimony on behalf of the Sea Grant Association (SGA) regarding our efforts to combat marine plastic debris. I am Ron Dearborn, Director of the Sea Grant College Program at the University of Alaska and incoming President of the Sea Grant Association. The Association consists of forty educational and research organizations dedicated to enhancing the Nation's capability to develop, use and manage our marine resources.

Awareness of the environmental and economic impacts of marine plastic debris is growing, due in part to the ever increasing use of plastics. The very qualities that make plastics useful to individuals and industry—their durability and longevity—make them a cumulative hazard in the marine environment. Discarded and abandoned plastics harm wildlife, foul our beaches, endanger the lives of divers and hamper boaters by fouling propellers and water intakes.

Although most of the research on the extent of the plastic pollution problem has been conducted in the Pacific, limited research on marine plastic pollution problems in the Gulf of Mexico and the Atlantic shows that the extent and nature of marine plastic pollution varies regionally:

Commercial fishing gear and packing materials from merchant vessels in the North Pacific often pose a severe hazard to marine mammals and sea birds;

Plastic debris from oil industry facilities, fishing and merchant vessels threatens sea birds and endangered sea turtles in the Gulf of Mexico, and washes up on Texas and Louisiana beaches in large volumes due to prevailing ocean currents;

In the Atlantic, one of the greatest problem areas is along the New York Bight where major metropolitan areas and congested shipping and boating lanes are concentrated.

Marine plastic pollution is primarily a problem of public attitudes. It can be greatly reduced by increasing public awareness of the effect of dumping litter into the ocean or on the shore. Technological solutions are also possible. Currently, ten states require that six-pack holders be degradable, rendering them less harmful to the environment in a shorter period of time. Development of degradable plastics for use in fishing gear may also be feasible. This is a long-term solution, however, and compromises may have to be made in the strength and efficiency of currently used materials. Because the effects of the by-products of degradations on the ocean environment are not understood, this potential solution should be approached carefully.

ONGOING MARINE DEBRIS PROGRAMS

The leading domestic program to combat marine plastic pollution is the National Marine Fisheries Service's Marine Entanglement Research Program. On a small budget, the Entanglement Program has funded projects to assess the extent of marine plastic pollution, investigate environmental impacts, define and undertake mitigation measures, and conduct public education campaigns.

The Center for Environmental Education (CEE) is a NMFS contractor and a major player in its own right. On contract with the Environmental Protection Agency, CEE produced a book entitled "Plastic in the Ocean: More than a Litter Problem", which is the most comprehensive public information publication to date on the scope of the marine plastic pollution problem. Funded by the Marine Entanglement Program and in cooperation with other organizations, CEE will produce a booklet on plastics pollution for the layman, and is designing public education programs for the Atlantic and the Gulf of Mexico.

Sea Grant activities to publicize marine plastic pollution began with the Pacific Sea Grant College Program's (PSGCP) involvement in the 1984 Workshop on the Fate and Impacts of Marine Debris held in Honolulu. The proceedings of the workshop, jointly published by NOAA and PSGCP, have been widely cited and are regarded as the major source of information on marine debris.

Sea Grant Marine Advisory Services and Communicators around the country have been involved in combating marine plastic pollution at the local level, often in cooperation with NMFS and CEE. Sea Grant advisory agents on all of our coasts have helped to coordinate beach clean-ups which temporarily eliminate plastic pollution and, more importantly, educate the public about the magnitude of the problem and its impacts. They have also published various types of public education materials such as brochures, articles for local newspapers, and newsletter stories.

Texas and Oregon Sea Grant have had especially effective progams to educate the public about marine plastic pollution, and these programs are stimulating new activity throughout the network of Sea Grant colleges. Texas Sea Grant advisory agents participated with CEE in a successful beach clean-up effort last year, and have introduced a number of innovative public education programs. Oregon Sea Grant's program has targeted the fishing industry and boaters as well as the general public. Most notably, Oregon Sea Grant is involved in a pilot Marine Refuse Disposal Project at the Port of Newport. Funded by the NMFS Entanglement Program, this is a cooperative project between the Port of Newport, Oregon Sea Grant and the city of Newport. The program has two major components: (1) developing optimal marine debris disposal facilities and (2) public education.

Two weeks ago when the Sea Grant community met here in Washington, the successful programs in Texas and Oregon as well as elsewhere were shared in meetings of Sea Grant Directors, marine advisory agents, and communicators. We can anticipate a heightened level of activity throughout the network over this next year. Earlier education programs undertaken by Sea Grant have proven to have long term staying power.

The U.S. Coast Guard recently recommended U.S. ratification of MARPOL's Annex V which, depending on implementing legislation, would prohibit ocean disposal of plastic debris from U.S. and foreign flag vessels generated in the course of vessel operations in our Exclusive Economic Zone. That means plastics must either be incinerated, or that disposal will have to be shoreside, thus creating significant new assignments for ports, especially small ports. In this light, the Newport project is important as an example of how small ports might handle increasing shore-side disposal of marine debris.

Contacts between representatives of the Sea Grant Association, NMFS and other groups involved in plastic debris activities is increasing. The Sea Grant network will continue to develop linkages with these organizations, both formal and informal, where possible and appropriate. A Sea Grant steering committee on marine debris, which I will chair, was formed during National Sea Grant Week, 19–22 July in Washington, DC. The committee will include additional Sea Grant directors, as well as representatives of the marine advisory programs and Sea Grant communicators. We look forward to working closely with other NOAA programs on marine debris issues in the future.

RESEARCH

Most scientists and resource managers who have looked at this problem feel that it is primarily a policy and education problem, and only secondarily a technical problem. That does not mean that there are no technical aspects that need study or that a substantial research agenda might not at some point arise, but rather that priority action and funding should be directed toward the following:

1. *Data collection.*—For the most part, data collection can best be done through add-ons to existing activities, piggybacking and buying into resource assessments and various other coastal and ocean activities. Supplementing NMFS resource assessment cruises is an obvious means. Buying into the fishery observer programs, is another. Without such means, costs will be extremely high. However, it would not be appropriate for existing activities to absorb additional duties without additional funding. Most of these activities are already short on resources.

The immediate needs are not well-suited to academic research, except where it can piggyback with on-going surveys, as in the case of sea turtle research. Data collection per se does not lead to acceptable student theses, which are the core of university-based research.

2. *Research into degradable plastics and substitute material.*—This may well be an area for accelerated research. However, there are a number of caveats. First, this is not primarily a marine problem, but one for the national research agenda. Second-

ly, most plastic materials are increasingly highly specific in nature. There are many, many plastics, and most will have to be examined and replaced individually. Third, we may well have to be willing to accept less effective replacements. Fourth, there are available paper substitutes for some of the most pervasive plastic problems: garbage bags, packing materials, carryout coffee cups, fast food packaging, etc. Substitutes may be more expensive due to consumer preferences, necessitating legislation or taxes to effect their use. Some of our universities have industrial research relationships with the plastics industry through their chemistry and engineering departments. This may become a valuable resource for us.

3. *Workshops.*—When this issue is better focused, it may be useful to sponsor a research workshop, or a series of workshops, to examine data collection and research needs.

POLICY CONCERNS AND RECOMMENDATIONS

Four Senate bills and an equal number of House bills dealing with various aspects of the marine debris problem are currently before Congress. However, the tasks before us today are to take a broad view and examine the potential for better inter- and intra-agency coordination of efforts to combat marine plastic pollution and discuss the formulation of implementing legislation for Annex V of the MARPOL Convention. Not long ago, Senator Stevens and 30 of his colleagues, including the esteemed Chairman, sent a letter to the President regarding government action to combat marine plastic pollution. In response, the White House Domestic Policy Council has requested that NOAA compile a report to Congress on the appropriate federal role with regard to this issue. The Sea Grant Association believes that there are several fruitful areas for government initiatives.

1. It is important that NOAA form an internal task force to help coordinate NOAA-wide activities and, more importantly, to encourage cooperative intra-agency efforts. This task force should include NOAA General Counsel, several elements of the National Ocean Service (the NOAA fleet, Ocean Assessment Division, National Marine Pollution Program Office, Ocean and Coastal Resource Management), National Marine Fisheries Service, Oceanic and Atmospheric Research, Sea Grant, and perhaps others.

2. The existing NMFS Marine Entanglement Program has worked well because it is grassroots-oriented and has a minimum of the usual organizational and structural constraints that too often tie such an operation up in knots. This activity should continue uninterrupted, albeit with input from an internal NOAA task force.

3. Ultimately, the marine debris problem is part of a much larger societal problem: We live in a highly technological, dynamic international economy which produces an extraordinary volume of materials which are not biodegradable, photodegradable or recyclable—or at least not readily so, in anything less than geological time. While some of the effects of marine debris are graphic and especially poignant, the basic problem is far more serious. Plastic garbage is proliferating and can be found throughout the environment, from wilderness areas to the sea depths. Many communities already face crises over the lack of adequate sanitary landfill sites, as the plight of the garbage barge "Mobro" has dramtically demonstrated, and the problem will get worse. If there is a serious will to tackle the roots of the marine debris problem, society and government will have to address the root problem of non-degradable and non-recyclable materials—and the question of true environmental costs. We would hope that the appropriate congressional committees would consider holding hearings on this larger set of problems.

4. With this problem as with others, solutions cost money. Better coordination can improve efforts, but the necessary regulatory, technical and educational activities will require additional funds. At a time when the domestic budget is largely in a steady-state situation (for the more fortunate activities), it is likely that additional activities in this area will come at the expense of other priorities. Some care needs to be taken in such a programs that work. Our primary focus will remain in public education, with our marine advisory agents in the field and the communicators. As a consensus develops regarding technical research, we will examine the potential for Sea Grant efforts in that area.

The Sea Grant Association will work closely with other NOAA programs to produce a coordinated plan of action to combat marine plastic pollution problems around the country. We look forward to cooperating with others with responsibilities in this area, such as personnel from the Coast Guard, Department of Interior, United States Department of Agriculture, Environmental Protection Agency, as well as the states and environmental organizations.

Statement of James R. Greco, Browning/Ferris Industries

INTRODUCTION

Browning-Ferris Industries is one of the nation's leading companies engaged in the collection, transfer, treatment, and disposal of solid and hazardous wastes. BFI operates throughout the country and therefore has a rare perspective on all of the different manifestations of waste-related problems.

Annex V of the MARPOL Treaty and its implementing legislation present an intriguing waste-related issue. To a company in the waste services business, it is reminiscent of some of the very basic environmental issues tackled by Congress in the late 1960's and early 1970's. Regarding solid waste disposal, for example, Congress sought to outlaw open, burning dumps back then. Now Congress addresses solid waste disposal by seeking to regulate contaminants that may leach into groundwater in parts per billion.

Relative to the dumping of garbage at sea, Annex V of MARPOL is at the open, burning dump stage. Even for many of us in the waste services industry, it comes as a surprise that ships by and large are not prohibited from dumping their garbage at sea. We believe that such a practice is inexcusable given the modern methods for disposing of waste easily and safely. We heartily applaud these subcommittees' efforts to clamp down on the dumping of waste at sea once and for all.

We at BFI, and undoubtedly others in the waste services industry, stand ready, willing, and able to handle solid waste generated at sea. Moreover, as corporate citizens of Texas, we are painfully aware of the toll that dumping of waste at sea takes on our beaches. We strongly support the MARPOL Annex V implementing legislation for these reasons, and believe that the role of government in assuring the existence of waste reception facilities need not be significant.

ADEQUACY OF U.S. PORT WASTE RECEPTION FACILITIES

BFI provides solid waste management services in well over 200 congressional districts in 42 states. Indeed, we operate in many foreign countries that themselves are or may become signatories to Annex V of MARPOL. Our domestic operations include practically all of the coastal states. Major coastal urban areas serviced by BFI include:

Boston, Massachusetts; Newark, New Jersey; Baltimore, Maryland; Norfolk, Virginia; Charleston, South Carolina; Jacksonville, Florida; Ft. Lauderdale-Miami, Florida; and Mobile, Alabama.

Biloxi, Mississippi; New Orleans, Louisiana; Houston-Galveston, Texas; Corpus Christi, Texas; Brownsville, Texas; Los Angeles, California; and San Mateo, California.

By serving so many areas with major ports, and indeed with major international airports as well, BFI already handles a sizeable volume of waste that is very much like the waste that would be subject to Annex V of MARPOL. From this experience, we believe that reception facilities at U.S. ports can easily be adapted to handle the increased volume of garbage that will be brought to port once Annex V takes effect.

Private waste services companies, like BFI, handle over 90% of the nation's commercial and industrial waste and an increasing percentage of the nation's residential waste. Because the nature of the waste that will be brought to port subject to Annex V is very much like the residential and commercial waste that BFI handles on an everyday basis, there do not appear to be problems so unique to shipboard waste to raise doubts about the private sector's ability to handle it.

From our observations, it appears that the quantity and quality of waste generated aboard ship is very much like that generated on land. Obviously, the number of individuals aboard ship at any one time and the length of their time at sea is data outside the scope of our knowledge. We can say, however given what we know about the number of crew and passengers who move through our nation's ports, that if each person at sea generates roughly four-five pounds of waste per day (the rough average generated on land), the volume of waste that will be presented at ports can be handled by state-of-the-art reception facilities.

Once Annex V is implemented, the required "waste reception facility" would be determined by the type of waste brought into port and by the applicable regulation. For example, wastes which are neither hazardous wastes nor regulated by the Department of Agriculture could be off-loaded from a ship using vehicles, cranes, and other equipment that already exists for such purposes. The waste would subsequently be put into containers suitable to the nature of the solid waste—similar to the containers you might see behind shopping centers and apartment complexes in your

neighborhood—and then loaded into trucks. These trucks would then transport the wastes to a state-approved disposal site.

Wastes currently regulated by the Department of Agriculture are required to be steam-sterilized or incinerated. Such treatment facilities could exist either on ship, within the port facility, or within an appropriate distance from the port. The residue from these treatment facilities, of course, must ultimately be landfilled.

These subcommittees may be unaware that the very treatment methods (incineration or steam sterilization) required by the Department of Agriculture for certain solid wastes are now being required by many state and local governments for medical wastes, of the nature generated by hospitals, medical clinics, nursing homes, and laboratories. This is of consequence to deliberations on implementing Annex V of MARPOL because the trend is now toward an increased number of treatment facilities in urban areas, even in the absence of Annex V.

Methods for handling waste aboard ship are not particularly complicated. Many large ships could house compaction equipment, which reduces the volume of waste and is largely odor free. Compaction equipment would also largely reduce the problem of such large quantities of waste having to be stored on ship as to interfere with the ship's operations. Beyond on-board compaction, however, we are certainly aware that ships now engage in on-board incineration. Steam sterilization aboard ship does not appear to be a sensible alternative because volume is not significantly reduced, though there is certainly no reason to rule it out.

Because of the confluence of Annex V of MARPOL and state requirements for specialized treatment of medical waste, therefore, the existence of reception facilities is probably not the problem it might have been a decade ago.

COST CONSIDERATIONS ASSOCIATED WITH WASTE PRESENTATION REQUIREMENT

The costs of disposing of waste generated aboard ship can be broken down as follows: (1) shipboard containerization and handling; (2) transferring shipboard waste to the dock; (3) transferring waste from dock to incineration or steam sterilization unit; (4) cost of incineration or steam sterilization process (which could have previously occured aboard ship); (5) cost of transporting residue from treatment unit to ultimate disposal facility; (6) disposal cost at landfill or waste-to-energy facility.

To obtain information about the costs that might be associated with disposing of shipboard wastes, we conducted a small survey of BFI operating units in Boston, Massachusetts; Norfolk, Virginia; Jacksonville, Florida; New Orleans, Louisiana; Houston, Texas; and Los Angeles, California. Based on assumptions that we believe are generally accepted in the waste services industry, we calculate that a vessel with a 50-person crew on a 10-day voyage might generate approximately 2000 pounds of solid waste, for which the ship might incur additional costs of roughly from $30–75 to dispose of its waste on land. This range represents the cost for servicing an eight cubic yard container of waste that has already been off-loaded. The cost varies due to different local operating costs, the degree of waste compaction, distance to the landfill, and variations in landfill fees. This cost range does not include any costs associated with incineration or steam sterilization or the transfer of the waste from ship to dock. Incineration or steam sterilizing waste may cost from $.25 to $.50 per pound of waste (typically inclusive of disposal charges). This would add to the ultimate charge to ships for presenting waste, but probably not dramatically.

AUGMENTING EXISTING WASTE RECEPTION FACILITIES

We believe that it will be unnecessary for the government to render financial assistance to assure the provision of adequate waste reception facilities at port. This assumes that reception facilities, though not always located within the actual confines of the port, would be reasonably accessible in nearby urban areas.

There will clearly be some small ports at which the ship traffic is simply insufficient to support a private investment in a waste reception facility. We do not believe that the reluctance of the private sector to provide such facilities at small ports should detract from passage of MARPOL Annex V implementing legislation. It is certainly within the capacity of the waste industry and the governmental authorities near such ports to come up with systems that adequately dispose of ship-generated wastes without the investment of significant governmental resources.

One indispensable component of providing private reception facilities, however, is the assurance that there will be adequate enforcement of the MARPOL Annex V implementing legislation and regulations. Without strong enforcement, the volume of waste upon which the provision of private reception facilities would be predicted could well not materialize. Here again, we are confident that enforcement is not an insurmountable hurdle in the overall context of MARPOL.

CONCLUSION

Implementing Annex V of the MARPOL Treaty will be a remarkable step forward toward the goal of keeping our shores clean. It will be a privilege for us in the waste industry to play a role towards such a worthy goal. The capability exists within the private sector to address the problem of receiving shipboard wastes, our best estimates indicate that the price for performing such a service will be minimal in the overall context of operating a ship, and we believe that the role of government in assuring that reception facilities are provided will be quite limited at most.

We recognize that there is still a great deal more information that Congress may need before it legislates in this area. We would be pleased to work with this subcommittee in your deliberations on implementing Annex V of the MARPOL Treaty.

STATEMENT OF STEPHEN K. LAMBRIGHT, VICE PRESIDENT AND GROUP EXECUTIVE, ANHEUSER-BUSCH COMPANIES, INC.

It is an honor and a pleasure to be able to submit this testimony regarding Anheuser-Busch's conversion to ecology packaging for all of its canned beers.

Anheuser-Busch ecology packaging includes:

The ecology lid—

One piece, Non-detachable tab opens can;

Replaces pull tab which can be removed and disposed of improperly; and

Conversion means one piece to be recycled rather than two.

Hi-Cone Photodegradable loop retainer—

Requires less energy to produce than paperboard;

Breaks down into dust when exposed to sunlight and other elements.

Nationwide voluntary transition to new packaging will be complete in December, 1987.

We made this transition because:

Fits with the Anheuser-Busch tradition of dedication to protecting and improving the environment;

Anheuser-Busch is pro-active in environmental problem-solving; and

Company recognized the need to take a leadership position within the industry.

ELEMENTS OF ENVIRONMENTAL PACKAGING

At Anheuser-Busch we have a genuine commitment to preserving our environment. We are always willing to do our part and actively seek ways to help solve environmental problems. It is in that spirit that we became the first brewer to totally convert to ecology packaging.

Our conversion includes two major differences in the packaging of our canned products. One is new containers featuring a one-piece lid with a non-detachable tab. The lid is opened when the tab is pulled forward. The tab then pushes back flat against the lid.

The new container replaces conventional can packaging which included a pull top with a detachable ring tab that was removed from the container. This created an extra piece of trash which might be disposed of improperly.

The other portion of our ecology packaging conversion includes a Hi-Cone photodegradable carrier loop retainer. These are the plastic rings which hold the cans together in six packs.

Use of loop retainers has been the rule in the beverage business since the 1960s when they for the most part replaced paperboard packaging which had been used to secure cans. They are preferred by consumers because of ease of handling, storage and disposal. The loop retainers also maintain their integrity in a variety of situations.

Though the original loop retainers were slow to break down, they did offer some conservation advantages. Their manufacture requires 75 percent less energy and 97 percent less water than does paperboard.

Several methods of improving carrier degradability were examined beginning in the 1970s. Over a period of time it was determined that the best method involved photodegradability—that is, a retainer which decomposes relatively rapidly when exposed to ultra violet energy (sunlight).

HOW PHOTODEGRADABILITY WORKS

Photodegradable materials react to the ultra violet energy from sunlight. This energy breaks down the plastic materials' complex long-chain molecules into shorter chains.

After the chains of molecules are broken down, the action of the other elements—wind and rain—causes the carrier to crumble into polyurethane dust. This process converts the carrier into non-toxic dust and does not inhibit normal degradation of the Hi-Cone in a landfill.

The amount of time required for the carriers to completely break down varies depending on the elements. The effects of ultra violet light are cumulative, so total decomposition normally takes only about 120 days. But the container can begin to lose integrity after six hours in direct sunlight and will lose the ability to hold cans after about 12 hours in direct sunlight.

It may be of particular interest to this committee to note that an unencumbered photodegradable Hi-Cone carrier floats. That allows it full exposure to ultra violet light and other elements which accelerate the decomposition process.

In our breweries, the photodegradable loop retainers are covered with dark plastic when not in use. Our wholesalers are careful to avoid storing their canned products too close to sources of ultra violet energy like mercury vapor lights and bug lights. Filtering sunlight through glass slows the degradation process somewhat. Initial decomposition in glass-filtered sunlight takes about seven days compared to the few hours of direct sunlight required.

FACTORS IN THE CONVERSION TO ECOLOGY PACKAGING

There were several factors involved in Anheuser-Busch's decision to convert our canned beer packaging to ecology lids and degradable Hi-Cone carriers.

Beginning in 1977, some states enacted laws requiring that canned beverages be packaged using degradable carrriers. At that time only one company manufactured the photodegradable retainers. There were only limited quantities and they were extremely expensive.

But like any free market situation, increased interest in the product stimulated competition. Other manufacturers began making the photodegradable retainers which led to improved availability and lower prices.

In 1985, for the first time technological advances and manufacturing capabilities caught up with demand. That made it possible for Anheuser-Busch officials to consider a conversion to ecology packaging.

Even with the advances, the conversion represented a major expense. Each photoderadable retainer cost about a penny more than its traditional counterparts. That represents a major expense for a company that sold 72 million barrels of beer last year . . . the equivalent of about 3.9 billion six packs of 12-ounce containers. Similarly, developing high quality one-piece ecology lids is also an expensive process and involves re-tooling of lid manufacturing plants, including those of Metal Container Corporation, and Anheuser-Busch subsidiary.

Top managers at Anheuser-Busch wanted to make the change. The move was clearly beneficial to the environment. In addition, our company is the largest brewer in the world and that brings the added responsibility of being the industry leader. We pride ourselves on taking new, innovative steps.

For several years prior to the ecology packaging conversion, our company's engineers had been working independently to find a way to save money in the packaging of our canned product. By 1985 they had designed a new spin neck can which would require a smaller lid and thus result in substantial savings.

Anheuser-Busch management decided to take advantage of these savings. But instead of chalking up millions of dollars in additional profits, the savings were used to help offset the additional expense of ecology packaging.

The conversion began in 1985. It will be complete in December when our St. Louis brewery—the last of Anheuser-Busch's eleven plants to make the change—finishes the changeover. Our brewery currently under construction in Fort Collins, Colorado is designed to handle the ecology packaging.

HERITAGE OF ENVIRONMENTAL CONCERN

It is only natural that Anheuser-Busch take the lead in this area. We have a long-standing commitment to protecting our environment and natural resources. Throughout our company's history, a commitment to quality has gone hand-in-hand with this commitment to a better environment. We believe our environmental programs combine sound, practical business sense with a desire to protect and preserve the environment and meet the obligations of being a good corporate citizen and a good neighbor in every community where we do business.

In the last two decades our company has grown into a diversified corporation. In addition to the world's largest brewing organization, Anheuser-Busch Companies, Inc. includes the nation's second largest producer of fresh baked goods, America's

largest producer of baker's yeast, and other subsidiaries whose products and services range from snack foods to real estate development to malt and rice production.

All of these companies reflect the corporate philosophy of being good environmental citizens. In fact, some of the subsidiaries are devoted entirely to environmental concerns.

For instance, Container Recovery Corporation, one of the nation's top two aluminum recycling businesses, is an Anheuser-Busch company. Founded almost a decade ago, CRC was established with the goals of reducing litter, reclaiming vital raw materials and conserving energy. Of course, we've recognized that voluntary recycling makes good business sense. It helps to reduce the inflationary pressures on beverage container costs.

Today CRC operates nationwide, recycling beverage cans to be converted to aluminum can stock. Since its inception, Container Recovery Corporation has reclaimed more than one billion pounds of aluminum, paying consumers nearly $250 million.

The growth of Container Recovery Corporation is an excellent example of the success of our philosophy that responsible environmental stewardship is good business.

But it is only one example of the many environmental projects undertaken by our company. We recycle our brewing by-products through land application projects which promote the growing of a crop-turf. Our land application project in Jacksonville, Florida—which won the President's Energy Efficiency Award in 1980—was recently expanded so that now 100 percent of the brewing process effluent from our Jacksonville brewery is treated by land application.

All of this helps show the kind of commitment Anheuser-Busch has made to preserving the environment. It is logical that the world's largest brewer take a leadership role in converting entirely to ecology packaging.

CONTINUING THE HERITAGE

We realize that the conversion to ecology packaging is only one step toward winning the fight against litter and helping to preserve our natural resources. But we think it is an important sign of our dedication to helping to win this battle.

Our company is involved in a broad range of programs designed to help find comprehensive solutions to the total litter problem. Earlier this month we were recognized for these efforts at the Take Pride in America awards presentation at the White House.

That specific award was given to the National Park Service for a pilot program to reduce litter on scenic rivers and waterways designed with and funded by Anheuser-Busch. From a test program on one Missouri River a year ago, the program has spread to several other states and is now in place on all scenic rivers in Missouri.

Our company is also a major supporter of Keep America Beautiful, Inc. and Operation Brightside. Both programs are helping to clean up communities across the country and are teaching young people the importance of non-littering and recycling behavior. This is where the real long-term solution to litter and solid waste difficulties lies.

We are proud to have taken the lead in voluntarily converting to ecology packaging. Our company is always striving to maintain a tradition of caring about the environment.

Anheuser-Busch is proud of its industry leadership position and anxious to assume the responsibilities that accompany that status. We will continue to explore new ways to help protect our environment and actively work to encourage others to do the same.

APPENDIX A.—COMPARISON OF HI-CONE DEGRADABLE CARRIERS TO PAPERBOARD

[Per 1,000 six packs]

	Paperboard	Hi-cone
Solid Waste [1] (by weight)	96.9 pounds	8.4 pounds
Solid Waste [2] (by volume)	1.71 cubic ft.	0.17 cubic ft.
Energy [3]	2 MM btu	0.489 MM btu
Water [4]	881 gallons	22.9 gallons

[1] Degradable Hi-Cone Carriers; Environmental and Economic Update, Illinois Tool Works, Inc.
[2] Ibid.
[3] U.S. Environmental Protection Agency Study, 1974
[4] U.S. Environmental Protection Agency Study, 1974 and DeBell-Richardson Study, 1974

THE WHITE HOUSE,
Washington, July 24, 1987.

Hon. TED STEVENS,
U.S. Senate, Washington, DC.

DEAR SENATOR STEVENS: This letter is in further response to your letter of April 2, cosigned by 29 of your colleagues, on the problem of plastic debris in the marine environment. Again, thank you for expressing your concern over this problem. The Administration has also recognized that the rapid accumulation of persistent debris in the world's oceans and the increasing evidence of its negative effects on human and marine resources warrant national attention.

Over the past three years, several Federal agencies have invested substantial resources toward understanding the effects of persistent plastic debris in the marine environment. These efforts have included: NOAA's marine entanglement research program; the Navy's waste management research for vessels at sea; the Coast Guard's leadership in the International Maritime Organization's consideration of Annex V, Regulations for the Prevention of Pollution by Garbage from Ships (one of five annexes to the International Convention for the Prevention of Pollution from Ships, also called MARPOL); the Department of State's negotiations with Pacific rim countries toward efficient monitoring of the incidence of marine debris pollution; the Department of Agriculture's review of its regulation of garbage entering U.S. ports on arriving foreign vessels; and the Environmental Protection Agency study on the extent of the marine plastics problem and the legal authority available for handling the problem.

As a result of these actions and in response to your letter, a high-level interagency task force, chaired by the National Oceanic and Atmospheric Administration (NOAA), has been established under the Domestic Policy Council to assess the problem and the need for research, identify potential reduction measures, and consider alternative actions to address the problem of plastic marine pollution. The task force is preparing a report, scheduled for completion within six to nine months.

On a related matter, in February 1987, President Reagan transmitted Annex V to MARPOL to the Senate with a strong recommendation for early ratification action. Effective enforcement of Annex V will be a major step in worldwide efforts to control the disposal of persistent debris in the marine environment. I urge you to do whatever you can to expedite the ratification process.

Thank you again for your letter. I look forward to working with you in our efforts to rid the oceans of plastic debris.

With best wishes,
Sincerely,

WILLIAM L. BALL, III,
Assistant to the President.

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